...NOLOGY DEPT.

POWER

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POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

POWER TO WIN — A Survey, page 63

Micromax Recorder at left shows temperature of 6 points in stator, and also of exciter air and outlet water of the hydrogen cooler of a generator in Ohio. Recorder at right shows temperature of the field. Watching these 9 temperatures is essential when carrying heavy load, though Recorders will also sound alarms if any one temperature exceeds a predetermined point.

OVERLOAD PILING UP?

Fields and Stators are Safer When a Micromax Recorder Watches Each

Loading of electrical generators on the basis of the temperatures of their stators and rotors is a practice which is now gaining ground, especially where load is so heavy that individual machines must carry even more than their usual percentage of nameplate-rated loads. Many power companies are now running special tests to determine the amounts of load which may be added, under specific conditions, to that given as maximum on the nameplate. Here are some of the factors to be considered:*

1. Each generator is a separate problem.
2. Nameplate data may provide unnecssarily large safety factor for load swings, unbalanced phases, etc.
3. Ambient temperature may be less than nameplate specifies.
4. Power factor may be higher than specified.
5. Change in terminal voltage may permit greater output.
6. When starting from low temperature, a generator can carry short-time excess load because of its own temperature lag.
7. In emergencies and for short peaks it may be more economical to operate at extraordinary temperature and thus age the insulation at an abnormal rate, rather than to provide the additional rated capacity for short-time loads.

When a generataor is loaded on the basis of temperature, we can supply its operator with complete temperature readings by means of two instruments — a Micromax Stator Temperature Recorder and its companion, a Rotor Recorder.

The Stator Recorder shows the temperature of 6 points, and of incoming and outgoing cooling medium. It sounds an alarm if a peak temperature is reached.

The Rotor-Temperature Recorder measures the resistance of the entire field and records it as temperature. Devised about 15 years ago, it has been less used than the Stator Recorder, for the reason that not every generator normally needs both instruments. As load becomes abnormal, or unfavorable power factor conditions occur, however, it is often wise to measure the field temperature directly.

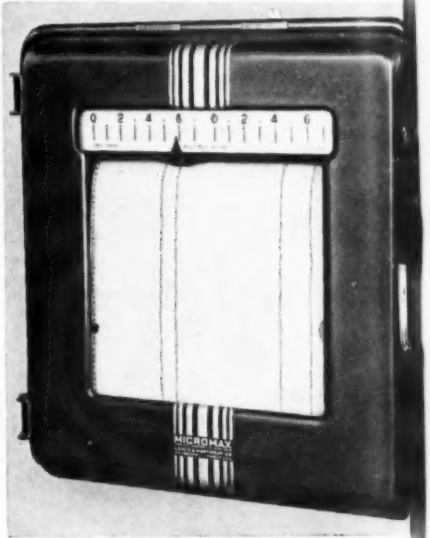
Further information in Catalog N-33-.61.

* Abstracted from a small portion of AIEE Miscellaneous Paper 43-93, "Interim Report on Emergency Measures to Increase Output of Generating Equipment and Systems," June 1943, available at 65¢ from AIEE, 33 W. 39th St., New York City.

ARMY E NAVY

depends on me!

A Slogan For All Americans



NEW! SPLIT-CHART MICROMAX FOR STEAM TEMPERATURES

When you want clearly to separate two temperatures recorded by one instrument, and they are almost identical, you can keep them from recording on top of each other by using a Split-Chart Micromax Recorder, shown above. All temperatures of one boiler go on left-hand; all of other boiler go on right-hand; thus there's no confusion. Designed especially for power-plants, with daily tear-off and multicolor record if desired. Further facts either from an L&N Engineer or from Folder N-163(2), as you prefer.

Jrl Ad N-33-161(4)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"). September, 1943, Vol. 87, No. 9. Published monthly with an additional Directory number in December. Return postage guaranteed McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. EDITORIAL AND EXECUTIVE OFFICES, 330 WEST 42ND STREET, NEW YORK, N. Y. Entered as second class matter, August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

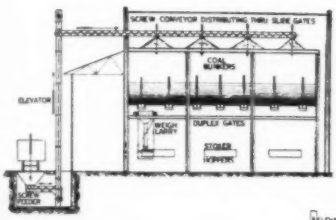
Your coal and ashes handling problem . . .

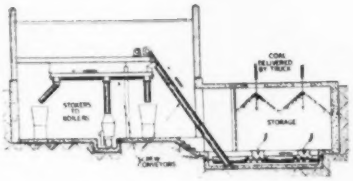
Manpower shortage?

Converting from gas or oil to coal?

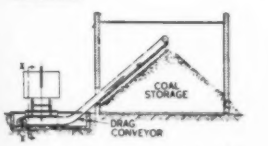
Old equipment?

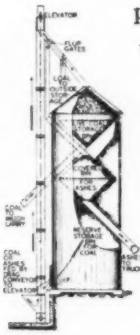
12 Typical Link-Belt solutions are illustrated

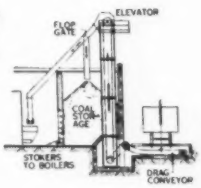


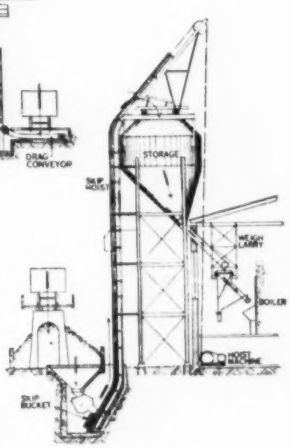


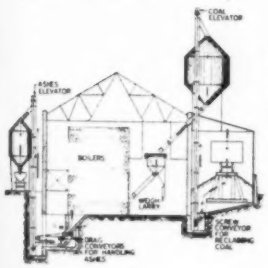
● Wartime exactions require revised thinking about coal and ashes handling. Fuel must be handled efficiently and man-hours saved in spite of stepped-up production. There is no one solution to the problem, so engineering skill and experience are needed in selecting the best type and arrangement of equipment to successfully meet each particular need. Whether your plant is large or small and no matter what your coal and ashes handling problem, there is suitable Link-Belt equipment to meet every requirement. Before you do anything else about it, talk over your problems with an experienced Link-Belt engineer. Send for Book No. 1510, "Solving The Problem of Coal and Ashes Handling in The Boiler Plant."

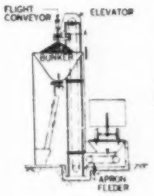


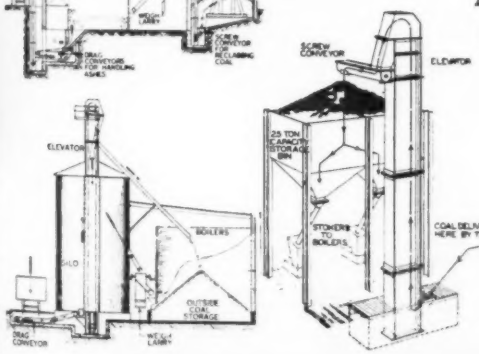


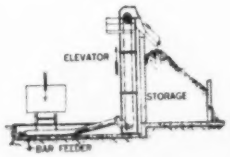


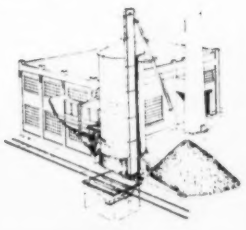












LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, San Francisco 24, Toronto 8. Offices, warehouses and distributors in principal cities.

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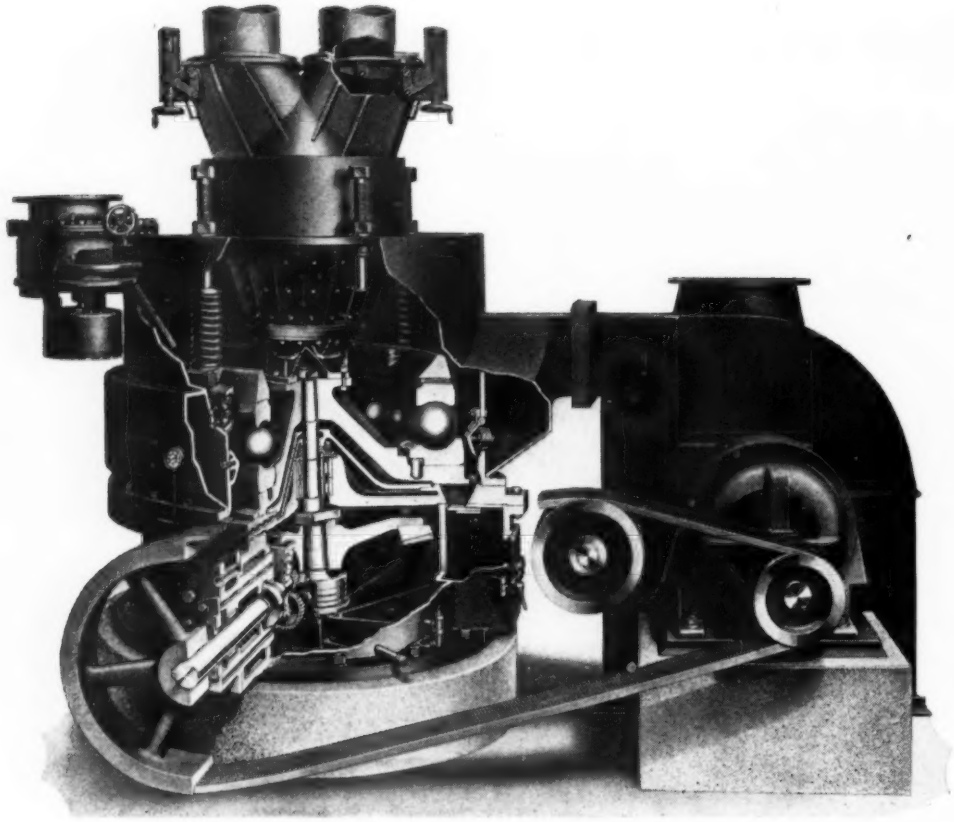
LINK-BELT

THE SYMBOL OF QUALITY · LINK-BELT COMPANY · L-B

COAL and ASHES HANDLING EQUIPMENT

For OIL during



B&W Type E Pulverizer for direct-firing pulverized-coal systems. Available in 15 sizes and in capacities from 3100 lb. per hr. to 25,400 lb. per hr., based on coal of 57 grindability pulverized to pass 65 per cent through the 200-mesh screen.

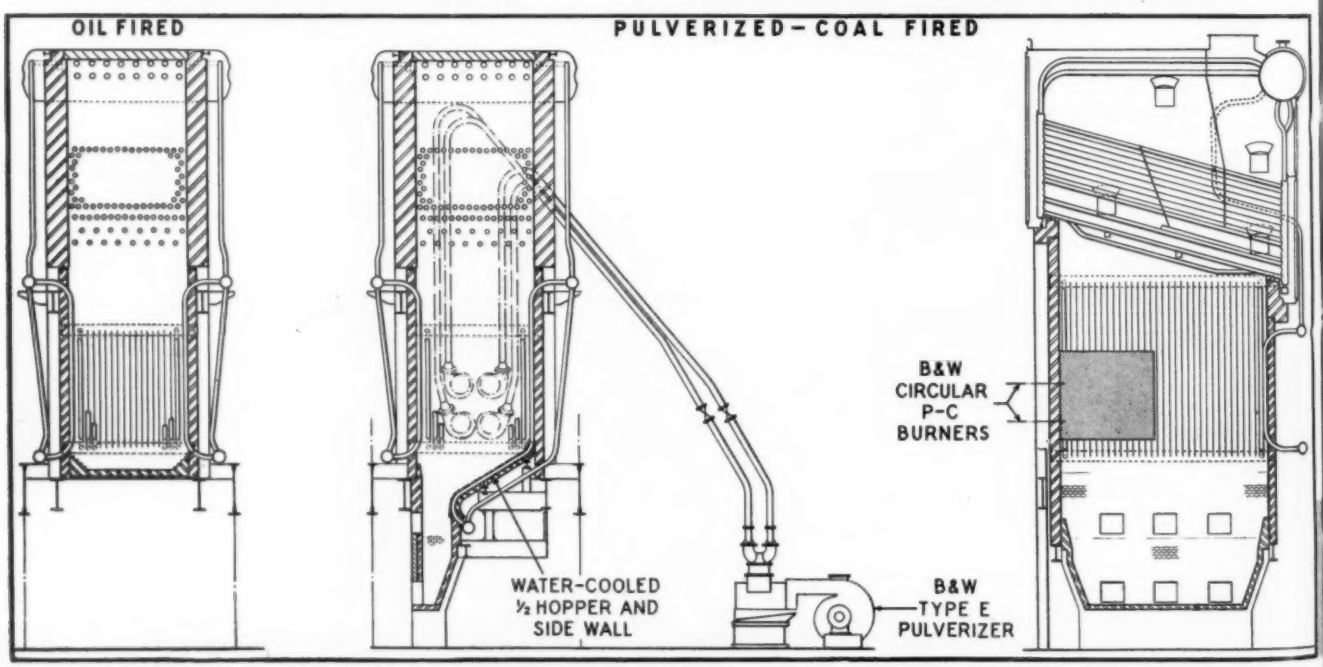
TYPICAL CONVERSIONS

Furnaces converted from oil firing to pulverized-coal firing vary considerably in the changes necessary. Cases in which a reduction in boiler capacity is permissible and increased furnace volume and water cooling are unnecessary, require minimum critical material.

The typical case shown below already had considerable water cooling. By converting straight water-cooled side walls to half hoppers along the length of the two boilers to provide ash pits, it was possible to maintain the minimum permissible capacity of 50,000 lb. steam per hr. Two Type E Pulverizers were readily applied to serve B&W Circular Burners installed in the refractory front walls.

Other cases in which no reduction in boiler capacity is permissible may require more extensive alterations, particularly if additional furnace volume is required and modifications of, or additions to, existing water cooling are necessary.

B&W Integral-Furnace Boilers, being designed for multi-fuel firing, have been readily converted merely by the installation of the coal handling and pulverizing equipment, no other changes being necessary.



TECHNOLOGY DEPT.

Conservation and Economy—Fuel Emergency and Afterward PULVERIZED-COAL FIRING

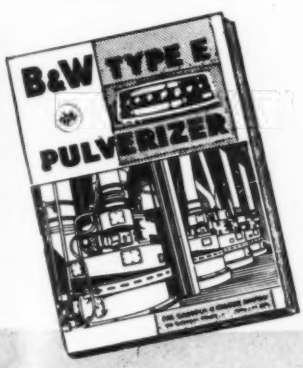
If you are burning oil in your boiler furnaces and are planning to convert to coal firing, either through necessity or for economic reasons, now is not too soon to consider the fuel-burning system to employ—not merely as a temporary expedient in the case of forced conversion, or as a stand-by, but for permanent installation. Such a conversion would not only be in the desirable direction of helping save oil for the future and for highly specialized uses in the interest of the national welfare but also would reduce your fuel cost in the face of advanced oil price due to shortage.

The B&W Direct-Firing Pulverized-Coal System with Type E Pulverizer is a profitable investment for such conversion. It is a fully co-ordinated system, from raw-coal bin to burners. It affords the most flexible and efficient means of burning coals of a wide variety, permitting the utilization of those that are most readily obtainable. This system reliably handles coal of a wide range of grindability and surface moisture content, and maintains capacity and fineness throughout the life of the pulverizer grinding-elements. Furthermore, this system is easily and safely operated, with pulverizer output controlled at one point—the primary-air damper—and the coal feed is automatically varied according to air flow, by the feeder controller.

The Type E Pulverizer is a sturdy unit with ball-bearing grinding element of materials that give the utmost in service, considering the nature of the materials handled.

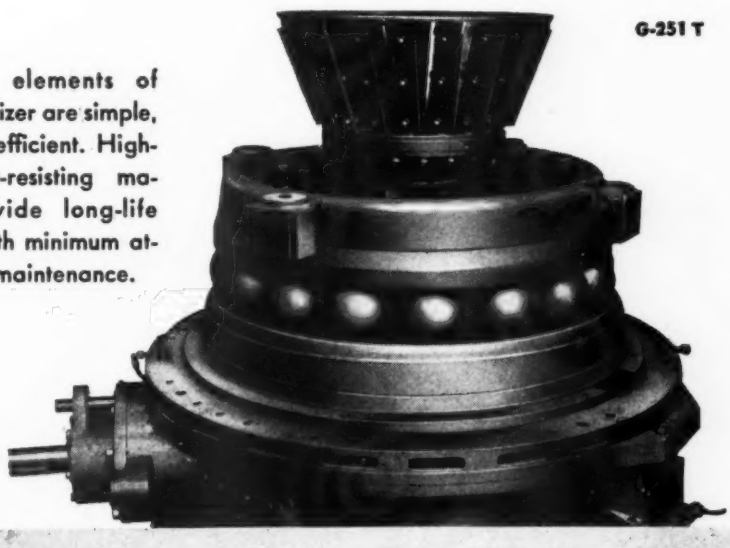
And B&W experience with pulverized-coal firing, which dates back to its early use for firing cement kilns, further suggests investigation of the B&W Direct-Firing System for your boilers.

Bulletin G-30A sent on request



Grinding elements of Type E Pulverizer are simple, sturdy, and efficient. High-grade wear-resisting materials provide long-life operation with minimum attention and maintenance.

G-251 T



THE BABCOCK & WILCOX COMPANY
85 LIBERTY ST., NEW YORK 6, N. Y.

BABCOCK & WILCOX

SYMBOLIC OF
THE TRADE MARKS OF
INDUSTRIAL AMERICA,
the monogram of Elliott Company typifies the engineering skill and productive capacity which is casting the shadow of defeat over Axis aspirations.
ONE OF AMERICA'S GREAT BUILDERS O

e total eclipse approaches

The war is now feeling the weight of one irresistible factor—the combined might of American manufacturers, whose thousands of production lines are disgorging the implements of mechanized battle in a volume almost unbelievable. *The trade marks of America are on the march.*

Every one of these thousands of trade marks represents a standard and type of engineering ingenuity peculiarly American, applied with an understanding of volume production and its possibilities far beyond that of any other people on earth. Each of them is the proud mark of successful individual enterprise, which here in America has come to its fullest fruition. *The trade marks of America are in the fight.*

The Axis powers do not know Production as we know it, nor did they realize the potentialities of American industrial organizations. Else they would not have chosen to start a mechanized war against, of all people, the nation which first introduced volume manufacturing, and whose mechanical ingenuity is supreme. The Axis lost the war at Pearl Harbor, unleashing for their own ultimate destruction the mighty forces of American individual enterprise. *The trade marks of America spell doom for the Axis.*

We believe the unified might of American management, American engineering, American labor, and notably of American individual enterprise, provides the most powerful single factor in the favorable course of the war, and that history will so record it. *The trade marks of America are winning the war.*

Elliott Company is one of those large manufacturing organizations whose products are of a basic type, equally vital and necessary in peace as in war. Elliott power equipment and Elliott process apparatus are today battling toward victory ashore and afloat, just as they will be working to produce the essentials of the greatly expanded scheme of living which will follow the day of victory.

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • SUPERCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

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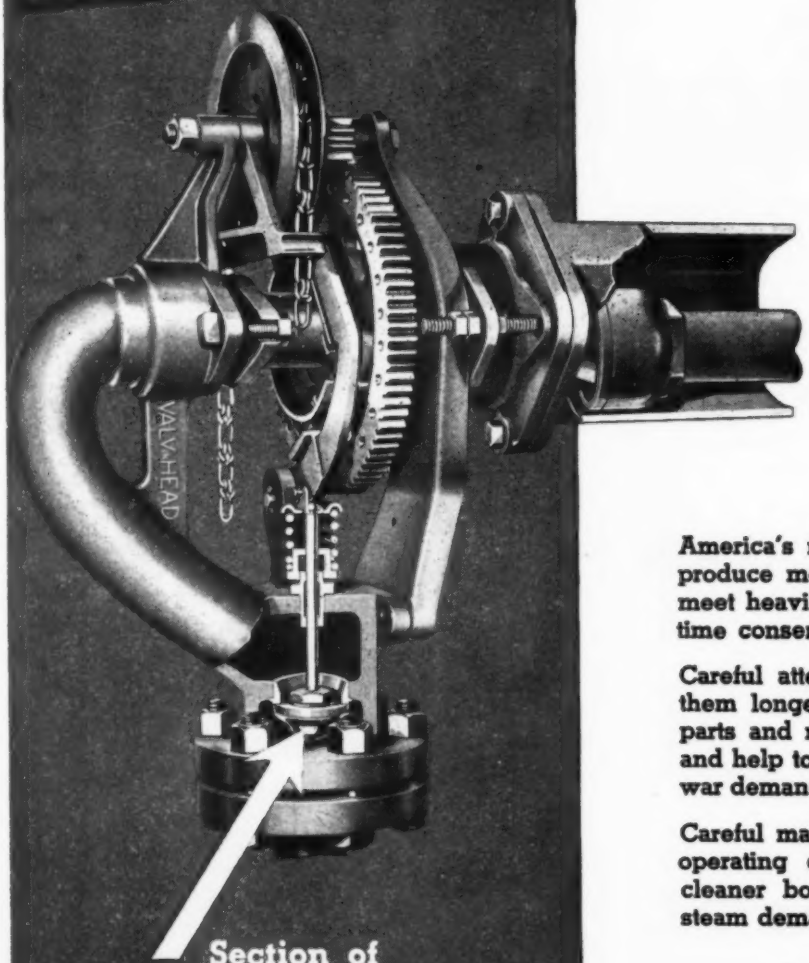
O POWER AND PROCESS EQUIPMENT

Get LONGER AND BETTER SERVICE FROM THE SOOT BLOWERS YOU HAVE



Section of
G9B SOOT BLOWER
Showing Poppet Valve

Care of VALVES AND PACKING SAVES STEAM ★ ASSURES EFFECTIVE BLOWING ★

America's march to victory demands that we all produce more—use less. You are called upon to meet heavier requirements for steam, at the same time conserving materials in every way possible.

Careful attention to your soot blowers will give them longer useful life—will conserve on repair parts and new blowers. It is economy for you—and help to us. We are called upon to meet heavy war demands, too.

Careful maintenance also keeps blowers in good operating condition at all times. The resulting cleaner boilers makes it easier to meet heavy steam demands.

Soot Blower Valves

All valve parts of Diamond G9B Soot Blowers are made of Monel metal or stainless steel. Under normal conditions they require very little attention for a long time. Oil should never be used on valve stems as it may form a gummy deposit

which may cause them to stick. In case a stem sticks, remove and clean it with emery cloth.

Should the valve need regrinding, remove gooseneck flange bolts, then remove cap screws which hold the bottom of the bracket to the gooseneck. Then remove the nut on the inner end of the sheave wheel shaft, which will permit drawing the gooseneck off the swivel tube without disturbing the packing. Take the gooseneck to a bench and regrind or replace the valve in the usual manner. Both valve disc and valve seat are renewable.

The valve may be reground without removing the head from the boiler. Remove the gooseneck flange bolts and the nuts on the end of the bracket stud. In this way, the entire unit may be pulled out and the gooseneck may be turned to a convenient position for regrinding the valve.

Soot Blower Packing

The G9B Soot Blower is packed around the swivel tube where it enters the gooseneck and also around the valve stem.

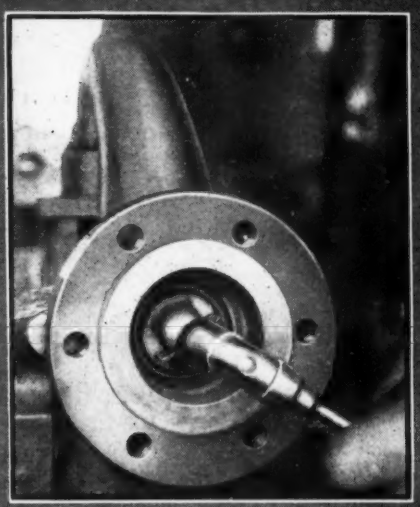
Special grade packing, made up in split rings of the correct size, is kept in stock at our factory.

If leaks develop which cannot be stopped by pulling up on the gland, add one or two rings of this special packing.

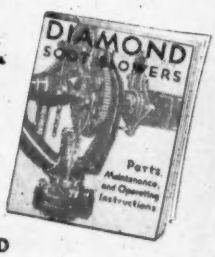
If it is necessary to repack the swivel tube gland, remove the gland bolts and pull out the gland far enough to allow insertion of new packing. Replace bolts, tighten as far as they will go. Remove gland again, insert an additional packing ring if possible and then back off the gland bolt nuts one-quarter to one-half turn so the packing will not bind the swivel tube.

To add or renew valve stem packing, remove the valve spring and unscrew the valve stem packing nut. The packing nut can then be filled with packing and replaced. Special tongs are available for removal of the valve spring.

METHOD OF GRINDING
G9B SOOT BLOWER VALVE



Write
For This
Booklet
on Care of
DIAMOND
SOOT BLOWERS



DIAMOND POWER
SPECIALTY CORP.
DETROIT, MICHIGAN
DIAMOND SPECIALTY LIMITED • Windsor, Ont.

THROW YOUR
INTO
THE FIGHT

FLY ASH TROUBLES

Switched High Pressure Design to

TAYLOR STOKERS

THIS COMPANY, manufacturing high grade paper, had previous experience with stokers not utilizing the underfeed principle. They had a fly ash problem. However, impressed by Taylor Underfeed Stoker's record for freedom from smoke and fly ash, they unhesitatingly designed Taylor Stokers into their new high-pressure unit. Since installation it has measured up to all expectations. The unit, which was installed last year, includes a Taylor Continuous Ash Discharge Stoker to generate 50,000 lbs. of steam per hour at 425 lbs. gauge, 650° F. total steam temperature.

This Taylor Stoker installation is burning either Indiana or West Virginia coals, both of which are available, with equal ease and freedom from smoke and fly ash nuisance.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.

2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.

3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.

4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.

5. **EFFICIENCY**—the proved **dollar** efficiency (**total** cost of steam production) as shown by actual performance in similar installations.

6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.

7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.

8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.

9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.

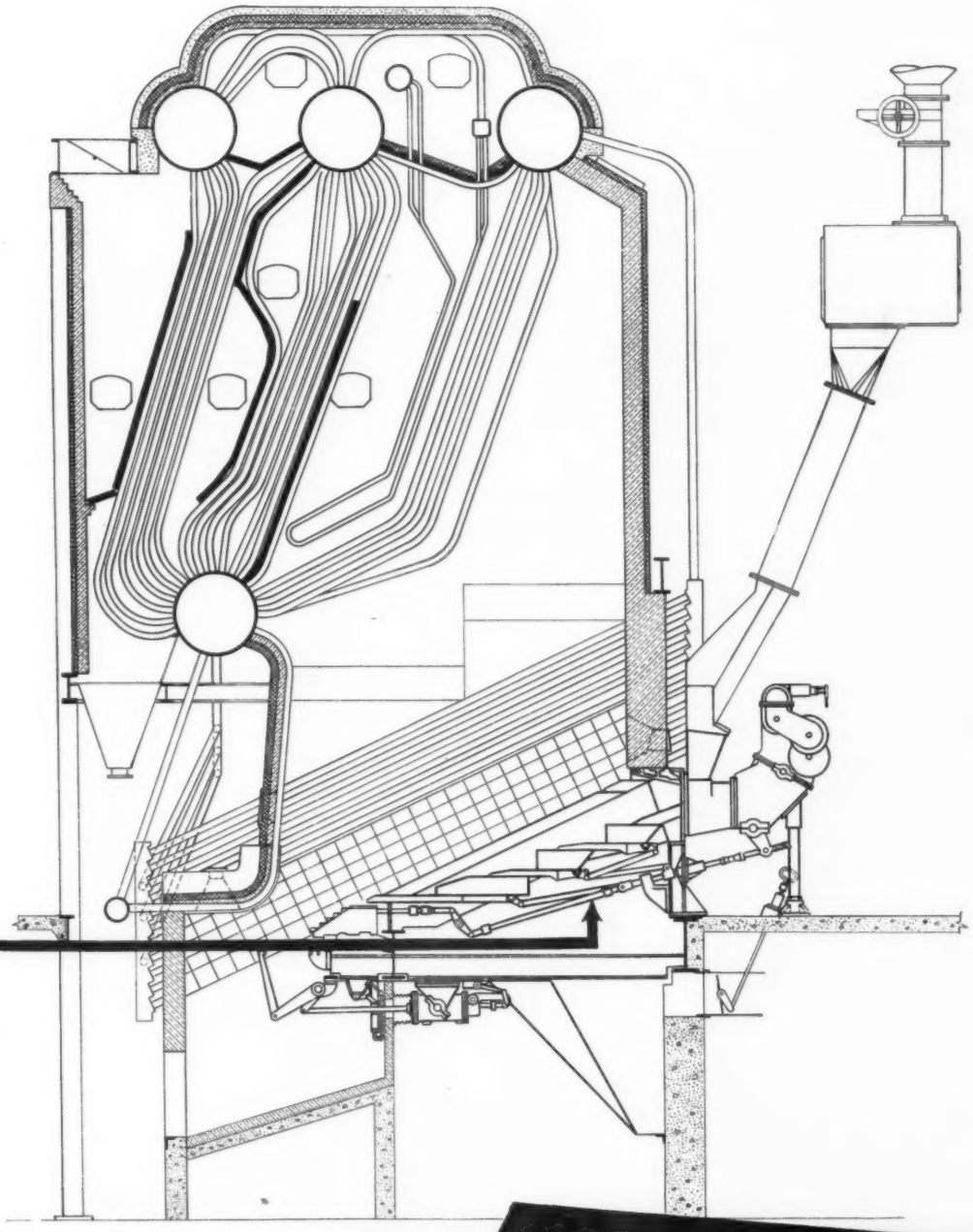
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.

11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.

12. **OBSOLESCENCE** — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA

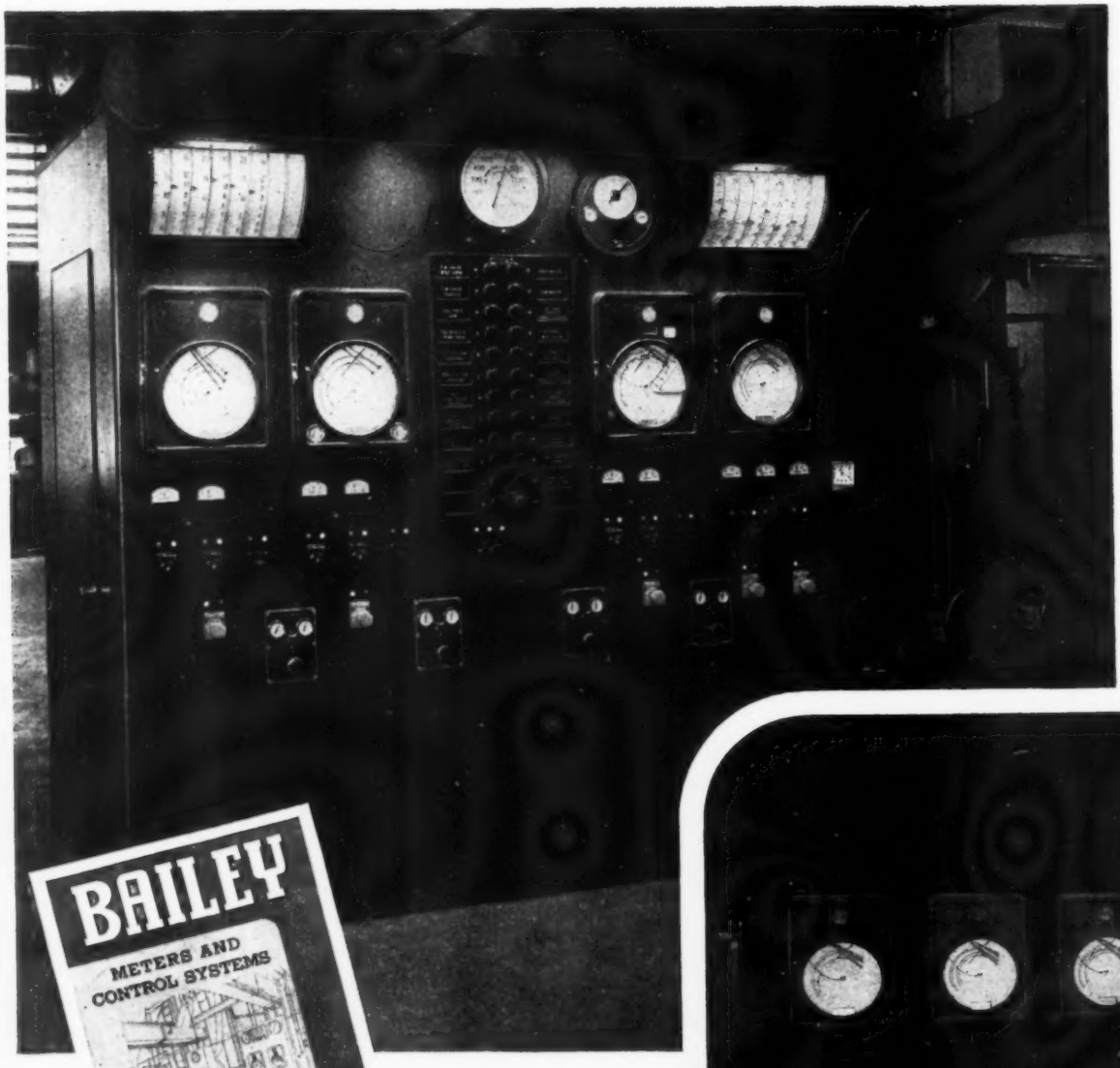


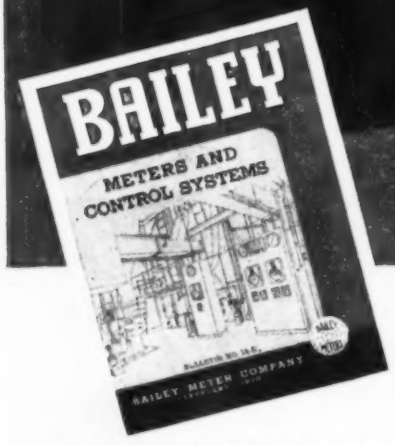
A-E-CO TAYLOR STOKERS
LO-HED HOISTS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

COMPANY

A Service FOR BETTER





This Bulletin, No. 15-B tells how and where Bailey Meters and Control Systems serve the steam plant. Write for your copy.

Panel for Bailey Combustion and Feed Water Control Systems serving a 450,000 lb. per hr. capacity pulverized coal-fired boiler.

•

Heat Balance and Feed Water Pump Control Panels for the same unit.

BAILEY METERS

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERH

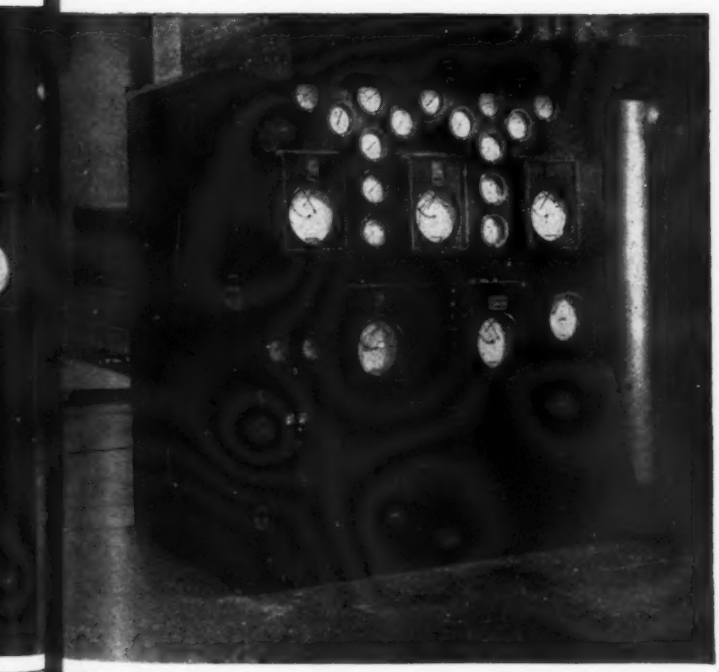
POWER PLANT PERFORMANCE

★ Instead of offering simply meters and controllers, Bailey Meter Company makes available a service which helps power engineers to improve plant performance from the standpoint of:

1. Continuity of Operation
2. Steaming Capacity
3. Fuel Economy
4. Conservation of Man Power
5. Safety

This engineering service starts with a careful consideration of the improvements which may be effected in the generation and utilization of steam and in the control of industrial processes. It continues with the application, design, construction, calibration, installation and adjustment of equipment necessary to secure the desired improvements.

Combustion control, for instance may be supplied as a remote manual system, a partial automatic system, or as a complete automatic system. In any event, the equipment furnished is tailored to the characteristics of the steam generating unit.



Although the basic component parts of Bailey Meters and Control Systems are standardized and produced in quantity to keep the selling price as low as possible, each meter or system is engineered, adjusted and calibrated to satisfy conditions as they exist in the plant where it is to serve.

When field tests must be run to completely adjust equipment to operating conditions, they are conducted by experienced Bailey Field Engineers who are permanently located in the principal industrial centers of the United States and Canada. Final adjustment of the Bailey Boiler Meter is done in this manner. A combustion test is conducted on the boiler to determine the lowest percentage of excess air under which it can be economically operated. With the aid of the boiler meter, which has been installed but not yet finally adjusted, and an orsat flue gas analyzer, the Bailey Engineer determines this lowest economical value. It is determined with respect to 1—CO losses, 2—unburned fuel losses, 3—smoke, 4—refractory deterioration due to excessive furnace temperature.

This value of excess air for which the Bailey Boiler Meter is adjusted may not represent the highest combustion efficiency possible, but it does represent the highest combustion efficiency consistent with economy, reliability and maximum capacity, which is after all the final result desired in boiler plant operation.

For an outline of the many ways in which Bailey Meters and Control Systems serve the modern steam plant, ask for a copy of Bulletin No. 15-B. G-15

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

ONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

*SPECIFIC

TIDEWATER LUBRICANIA

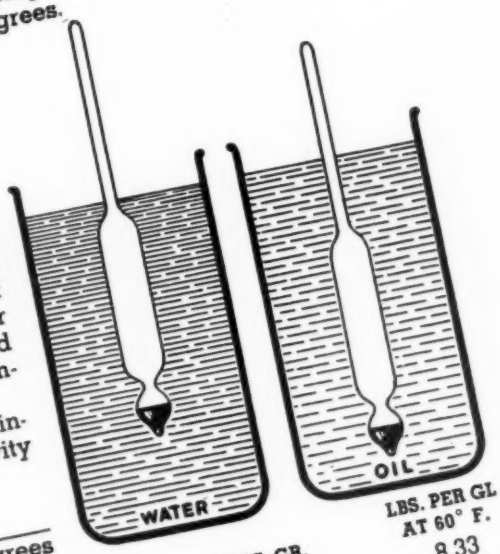
DEFINITION: The gravity or density of a liquid is a numerical value which enables the determination of the weight of a known volume of the product.

GRAVITY A. P. I. The gravity of petroleum products in the United States is generally obtained by means of a hydrometer graduated on the A.P.I. (American Petroleum Institute) scale. It is reported as Gravity in degrees A.P.I. Unless otherwise stated, it applies when the product is at a temperature of 60° F. If taken at a higher or lower temperature a correction is applied to reduce the reading to the standard 60° F. temperature.

The A.P.I. Gravity bears a definite relationship to specific gravity according to the formula:

$$\text{Sp. Gr.} = \frac{141.5}{131.5 + \text{A.P.I. degrees}}$$

The A.P.I. scale differs from the Baumé scale (used for non-petroleum liquids lighter than water) by only one-tenth to seven-tenths degrees.



EXAMPLES:	GRAVITY A.P.I.	SPEC. GR.	LBS. PER GL AT 60° F.
Water (distilled)	10°	1.00	8.33
Kerosene	36-40°	0.84-0.82	7.03-6.87
Machine Oil (paraffinic)	24-30°	0.91-0.88	7.58-7.30
Machine Oil (naphthenic)	18-22°	0.95-0.92	7.88-7.68

SIGNIFICANCE: Gravity is of little significance to the user. The quality or suitability of a lubricant is more readily appraised by other tests.

DRUMS! DRUMS! DRUMS!

War needs make it extremely important that all empty drums be returned immediately.

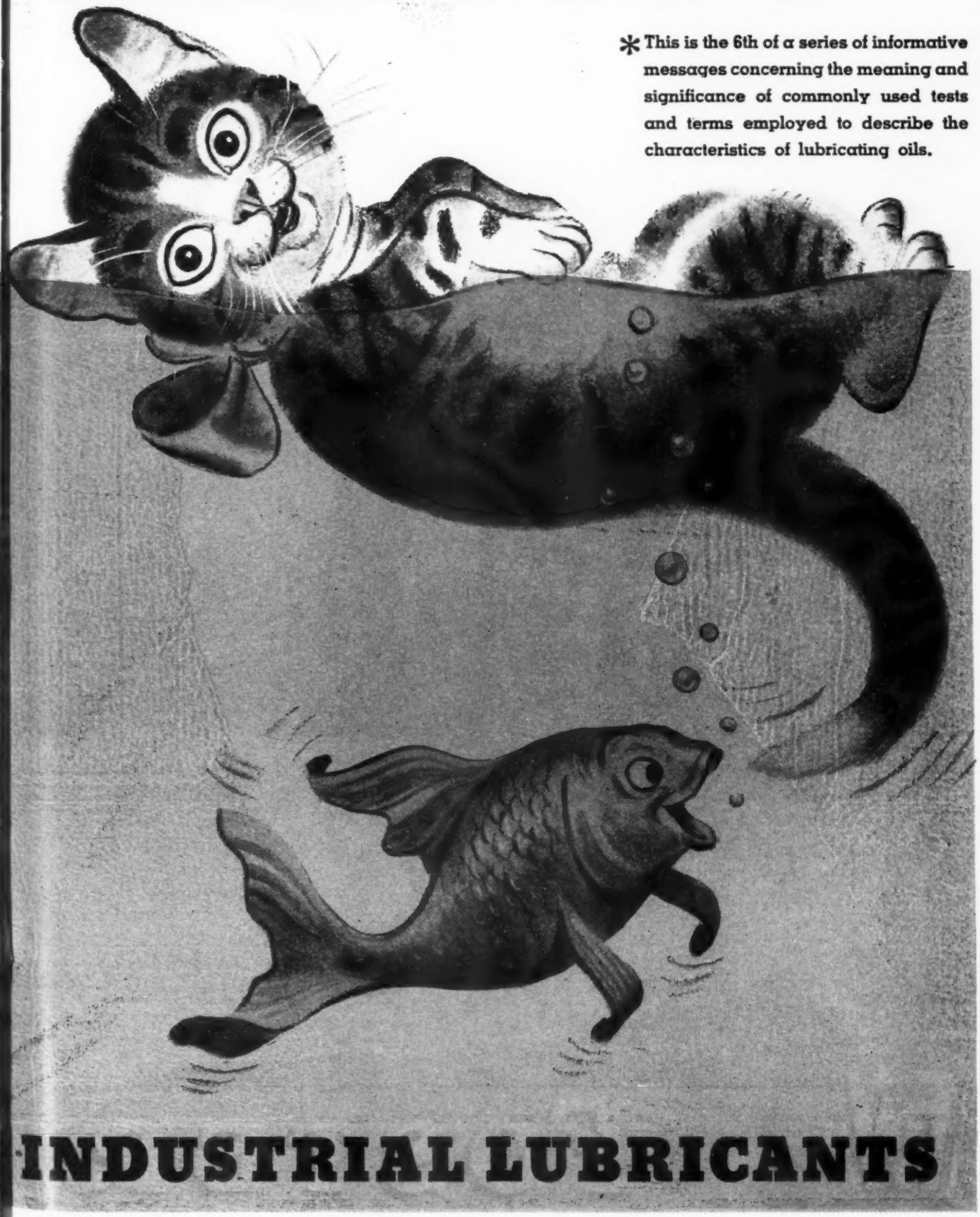
TYCOL lubricants are made from the most suitable materials and carefully refined to meet the most stringent laboratory specifications and service requirements. Scientific manufacture from the finest available material assures unvarying high quality in all Tycol lubricants.

TIDE WATER ASSOCIATED OIL COMPANY

Eastern Division: 17 Battery Place, New York 4, N. Y.
Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.
MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE **TYCOL**

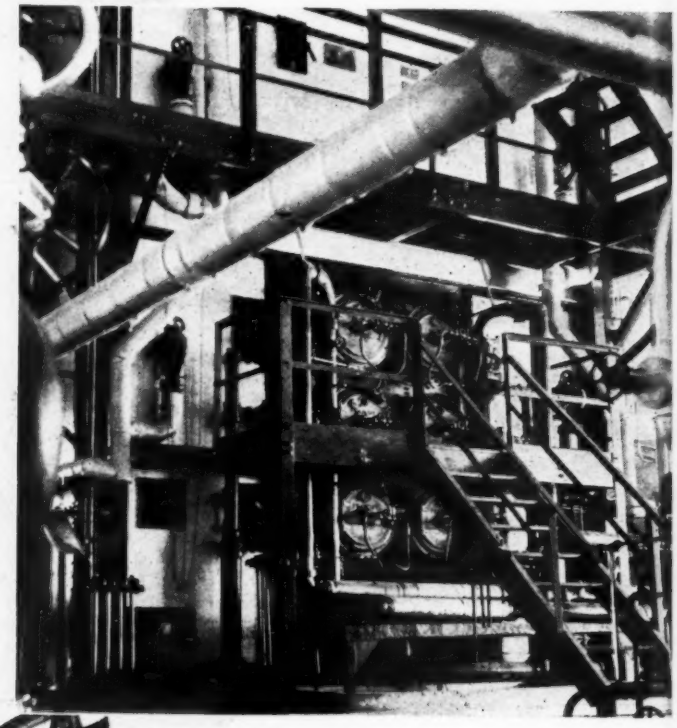
GRAVITY



* This is the 6th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

INDUSTRIAL LUBRICANTS

Serving on



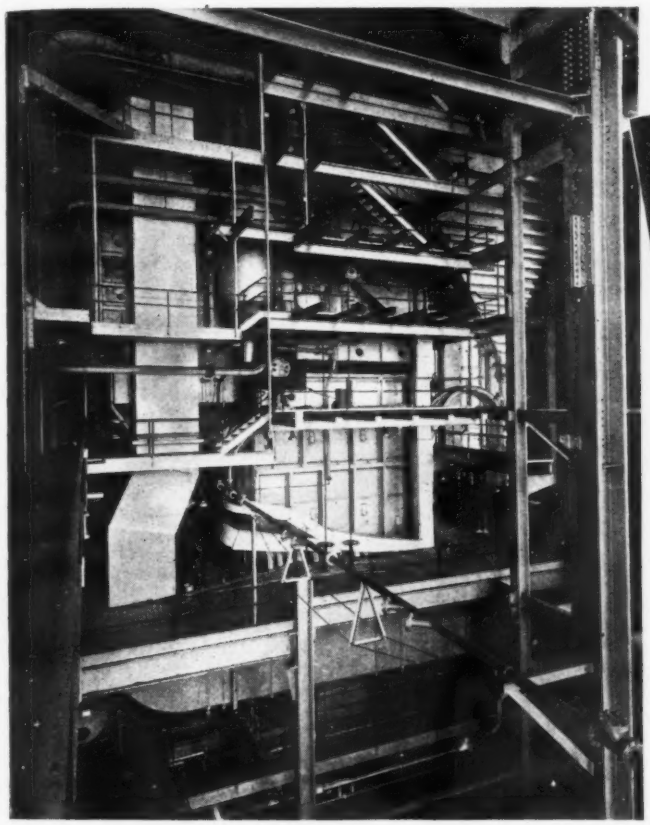
★ OIL REFINERY—S-A steam generator having capacity of 75,000 lb. of steam per hour at 275 lb. per sq. in. pressure and 680 deg. F. Fuel is combination gas and oil.

★ From destroyers to battleships — aircraft carriers to inland waterways towboats — Foster Wheeler marine steam generators are in the fight for Liberty.

FW

FOSTER

LAND and SEA



★ PUBLIC UTILITY—Three-drum steam generator with superheater, economizer, and tubular air heater; capacity 400,000 lb. of steam per hr. at 880 p.s.i. and 900 deg. F. Fired with pulverized coal.

★ INDUSTRIAL PLANT — Three-drum steam generating unit of 210,000 lb. of steam per hr. capacity, at 275 lb. per sq. in. pressure and 520 deg. F. Stoker fired.

IN addition to hundreds of marine boilers for the Navy, Coast Guard and Maritime Commission, Foster Wheeler, since Pearl Harbor, has built 138 stationary boilers ranging in capacity up to 500,000 lb. of steam per hour.

40 for CHEMICAL PLANTS	10 for OTHER WAR PLANTS
19 for ORDNANCE PLANTS	10 for PUBLIC UTILITIES
16 for OIL REFINERIES	43 for EXPORT TO ALLIED NATIONS

FOSTER WHEELER CORPORATION
165 Broadway New York 6, N. Y.

WHEELER FW

A reminder — to users of rubber products

In buying industrial rubber goods today the skill and integrity of the manufacturer are more important than ever before.

In building to war grade specifications — either from natural or synthetic rubber — the only ingredient that is not now rationed is "know-how"!

Goodyear's war grade products are constructed with the same capability that made their peacetime predecessors first choice in industry for standout performance.

In materials, they are built from the highest-grade stocks now obtainable under WPB regulations.

Those made from synthetic rubbers embody Goodyear's two decades of experience in pioneering and perfecting synthetics impermeable to oil and gasoline.

All industrial rubber products are correctly specified to the job by the G.T.M. — Goodyear Technical Man — whose practical knowledge, as you know from experience, assures proper application and trouble-free performance.

Don't take chances, get the best in rubber — *Goodyear rubber*. To bring the G.T.M. to your office, write Goodyear, Akron 16, Ohio or Los Angeles 54, California — or phone the nearest Goodyear Industrial Rubber Goods Distributor.

FREE—TO MAKE YOUR RUBBER LAST LONGER
Send for manual "GOODYEAR INDUSTRIAL RUBBER PRODUCTS CONSERVATION" — filled with complete instructions for care and repair of hose, belts, etc. Thousands in use.
GOODYEAR
INDUSTRIAL
GOODYEAR
THE GREATEST NAME IN RUBBER

HERE'S NEW Double-Trouble for V-Belt Wear!

1

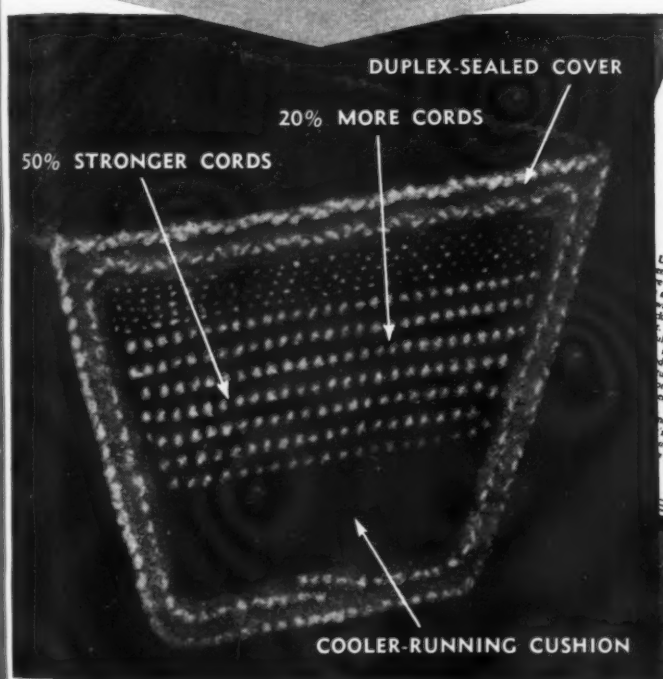
BUY THE BEST BELTS:

You'll get the "jump" on maintenance with Texrope Super-7's design-against-wear construction! 20% *more* pulling cords. 50% *greater strength* in every one because they're made by the special Flexon process. That adds up to extra pulling power, less stretch. A cool-running rubber cushion fights flexing heat. Tough Duplex-Sealed cover seals belt against grit, grime, and moisture. When you *do* need new belts *invest in the best* — Texrope Super 7!

2

USE THE BEST CARE:

Over 75,000 men in industry are getting a head start on longer V-Belt life because they've got Allis-Chalmers' new handbook: "Plain Facts on Wartime Care of Rubber V-Belts." It gives you the inside story on "how V-belt anatomy affects maintenance"... "good-rule-of-thumb for tension"... a lot of other tips. Excellent for training new men, it's packed with valuable data. For your *free* copy, tear off the coupon and send today.



ALLIS-CHALMERS

TEXROPE* SUPER-7 V-BELTS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by Allis-Chalmers. Available in all sizes.

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive free of charge a copy of your "Plain Facts on Wartime Care of V-Belts".

(Name)

(Title)

(Company)

(Street Address)

(City and State)

A 1628-9

"FIRSTS" ARE A

"They laughed when we told them we'd run it with air."

. . . BUT TODAY 90% OF ALL NEW CONTROL SYSTEMS FOR BOILERS ARE AIR OPERATED

HABIT... *with Hagan!*

CREATIVE engineering, the knack of starting with little more than an idea—plus sound engineering practice, which takes hold of the device and makes it work—are an unbeatable team. The entire Hagan history proves this point. Its imposing record of "firsts" in boiler operating equipment is matched by an equally impressive story of performance.

Twenty-six years ago Hagan engineers started from scratch. They saw the growing insufficiency and waste in manual combustion control and resolved to correct it. The pioneering they did then revolutionized combustion control practice for all time. And from that day to this they have never ceased their research into boiler operating needs. One development after another has maintained this leadership.

You can see the effect in your own plant. And if you happen to be an "old timer" you may know how many of the improvements you value so highly today got their start on a Hagan drafting board. A number are mentioned here. Look them over.

This probably explains, better than anything else could, why you find Hagan Automatic Combustion Control and auxiliary equipment in so many of the finest power plants. It is also the best possible reason for learning more about what it could do for you. Write or call. We'll gladly send complete information on any one of these developments.

HAGAN FIRSTS

1. Hagan was first to recognize the need for incremental control—that is, a control that would operate in accord with the demand for steam rather than to shift from one extreme to the other, as had been the custom prior to our advent into the field.

2. Hagan was first to divide the load evenly and automatically among the boilers in service in a given plant.

3. Hagan developed the first control valve having independent adjustments for maximum and minimum . . . the roto-reciprocating valve.

4. Hagan was first to use compressed air in a combustion control system. Today 90% of all new control systems for boilers are air operated.

5. Hagan was first to develop control for gas-air proportioning.

6. Hagan was first to apply control to combination fired boilers.

7. Hagan was first to start and stop pulverized fuel burners automatically on combination fired boiler jobs.

8. Hagan was first to apply control to soaking pits, in the metallurgical field.

9. Hagan was first to apply control to hydraulic couplings in connection with complete boiler control.

10. Hagan was first to apply control to marine boilers.

11. Hagan was first to control pulverized fuel firing in metallurgical furnaces.

12. Hagan introduced the V-port butterfly valve, making possible accurate control in large lines, even at low flows.

HAGAN
HALL
BUROMIN
CALGON

HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

Easy

A Help

Simplicity of Design Means Easier Maintenance

Here's how easily the "King-clip" valve can be disassembled

Unscrew two nuts at top of clip and entire bonnet-stem-disc assembly can be lifted from the body. Complete accessibility for inspection or repairs is the work of a few minutes.

"KING-CLIP" GATE VALVE

Servicing - - -

for the Maintenance Man

So simple in design, so sturdy in construction, so resultful in last-ability is the "King-clip" valve, only a minimum of maintenance is required to keep it in good working order. And when service is required, the ease with which the valve can be disassembled is a real time and labor saver.

The illustration shows the ready accessibility of all parts for inspection and repairs and how few parts there are. Any maintenance man knows that this provision for quick servicing is a long step toward the uninterrupted production hours he is striving for.

A further aid to the attainment of easier and more efficient maintenance is the precision-gauged manufacture of replacement parts, assuring an exact duplicate of any part that may have to be renewed.

The "King-clip" is built for tough going and with ordinary care it will keep on delivering production hours at the lowest possible maintenance cost.

A Lunkenheimer distributor is near you to help you get what you need. His complete facilities are at your service.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

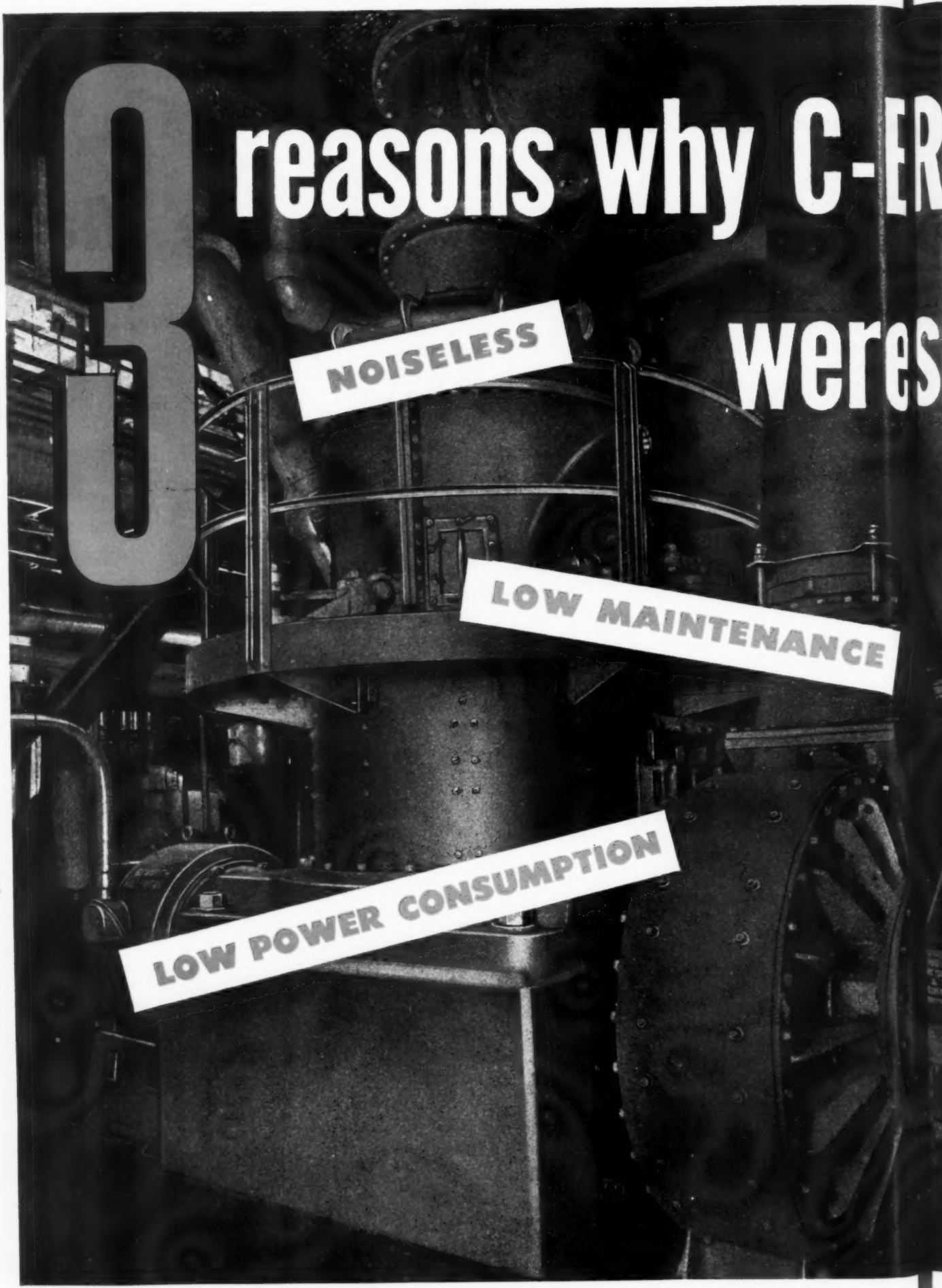
NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

Circular No. 504 is fully descriptive of the "King-clip" Valve. Get a copy from your Lunkenheimer distributor or write us direct.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

No. 5-86-42


3 reasons why C-ER
weres
NOISELESS
LOW MAINTENANCE
LOW POWER CONSUMPTION

ERaymond Bowl Mills
eselected for more than

50%*

of all pulverizer capacity for boilers ordered since January 1st, 1942!

Certainly there are other reasons for the remarkable rise of the C-E Raymond Bowl Mill in a brief period of eight years to its present position of preference among power engineers.

Yet again and again we find many users of the Bowl Mill emphasizing its exceptionally quiet operation, its low maintenance costs and its high output per kw-hr. They seem to take for granted the ability of the mill to turn out the quantity and fineness of coal desired because with the Bowl Mill this becomes a matter of routine performance. But apparently they can never quite accustom themselves to the idea that a coal pulverizer can be as quiet as the Bowl Mill or cost so little to operate and maintain.

These three big advantages attested to as they are by such pronounced customer preference merit the consideration of every engineer who influences the selection of pulverizer equipment.

*Percentage based on capacity of pulverizers sold for direct firing of boilers for 16 month period ending May 1, 1943. Based on statistics of pulverizer sales as compiled by U. S. Government and American Boiler and Affiliated Industries. A-748

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

Mechanical

THEY PREFER TEXACO

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

TEXACO

REG. T.M.

TEXACO

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—C E

Sky-Hook

KEEPING runways clear for take-offs and landings of fighters and bombers is the specialized job of this giant "Tournacrane" powered with a Cummins Diesel. This new and interesting mobile crane is typical of the many important wartime uses of Diesels.

To keep Diesels at maximum efficiency, not only in the service of our Armed Forces, but in war plants, lighting plants, pumping stations, etc., operators everywhere are lubricating them with Texaco.

Texaco Algol or *Ursa Oils*, for example, keep engines *clean*. Their use assures long life of bearings, pistons and liners, free rings, compression-tight seal, full power, and *fuel economy*.

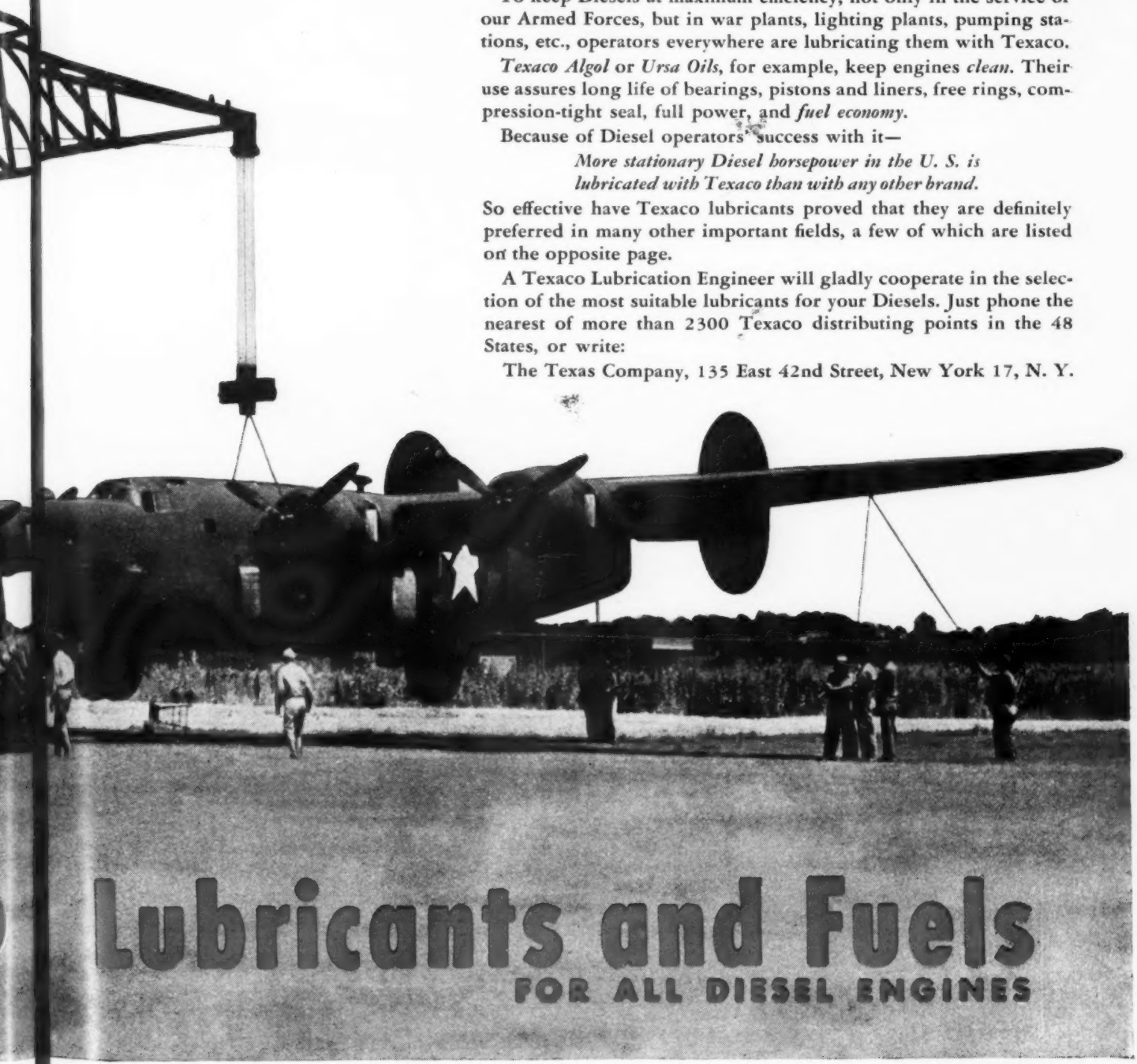
Because of Diesel operators' success with it—

More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

So effective have Texaco lubricants proved that they are definitely preferred in many other important fields, a few of which are listed on the opposite page.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your Diesels. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

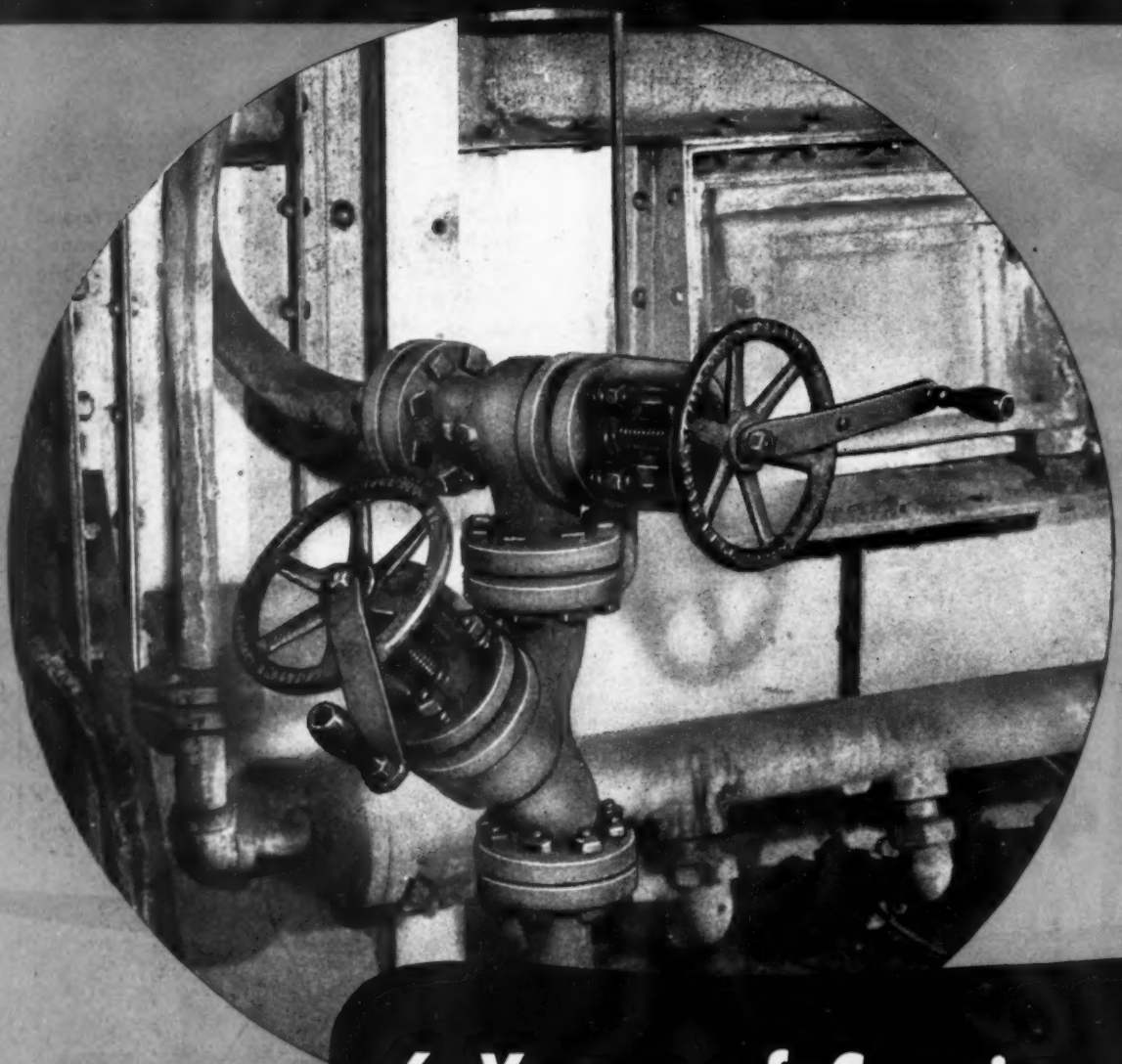
The Texas Company, 135 East 42nd Street, New York 17, N. Y.



Lubricants and Fuels
FOR ALL DIESEL ENGINES

—C ELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

The Proof of The Pudding



6 Years of Service...
28 Yarway Seatless
Valves Still "Drop-Tight"

YARWAY

at WYANDOTTE

THAT is the story at Wyandotte Chemicals Corporation's Michigan Alkali Div. Power Plant.

Such evidence of satisfactory service needs little comment—is ample proof of the soundness of design and metallurgy known and appreciated by more than 12,000 Yarway Blow-Off Valve users.

Eight Yarway Unit Tandems are used in the new Integral Furnace Boiler—five on main boiler blow down lines and three on water-wall drains —for these valves are equally suitable for blowing or draining and sealing.

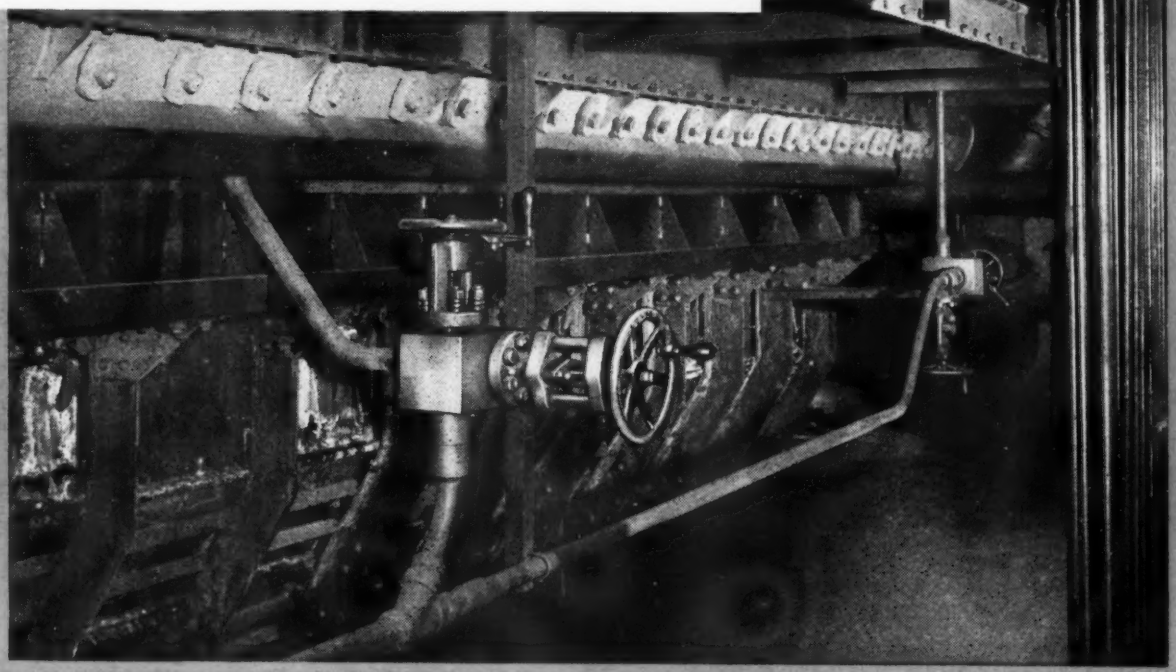
Why not look into this finest Yarway high pressure blow-off valve—the valve that has made such records as, "3000 blows at more than 1300 lb boiler pressure, without replacement of a single part or repairs of any nature," in the plants of leading utilities and industries.

There is a Yarway Blow-Off Valve for every pressure, purse and purpose.

Write for Catalog; section B-422 for pressures up to 400 lb, section B-431 for pressures up to 2500 lb.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Phila. 18, Pa.

The Natural Selection was YARWAY UNIT TANDEM Blow-off Valves for New 1000psi Boiler



BLOW-OFF VALVES

ASH

Originators and Builders

of Modern Ash and

Dust Handling Equipment

In order to compare the systems of modern ash handling a brief history of the development of this industry since 1915, which is about the year modern ash handling started, will help.

In 1915 boilers were hand fired, chain grate stoker fired, or underfeed stoker fired. Ashes from the smaller boiler units were pulled from the ash pits by hand, and shoveled into wheelbarrows or some similar conveyance. From the larger boilers they were stored in ash hoppers and discharged through ash gates into an industrial car which conveyed them to a fill or to a skip hoist pit. Ash hoppers at this time were constructed of concrete or steel plate and the ash gates were generally simple metal slides made of steel or cast iron plate held in a simple frame. So far as we know, the first cast iron hopper under boilers of any size was installed in the plant of the Republic Iron and Steel Company at Youngstown, Ohio, and also in this plant was installed a roller type ash gate to control the flow of ashes from the hopper. After this job proved quite successful, installations of slab type cast iron plate hoppers controlled with roller type gates were used, but as time went on, the stress and strains in the slab type hoppers caused cracks to develop and failure of the hopper resulted. This failure led to the development of the sectional cast iron hopper supported by a framework of structural steel and this scheme of using the steel for strength and the cast iron plates to resist corrosion is still the accepted method of ash hopper construction today.

The roller type gate proved to be the proper scheme and the only disadvantage in the earlier designs was the continuous leaking of quenching water through the gate clearances on the basement floor. During these early years dump plate stokers were used and the amount of water for quenching was relatively small, but this became very much worse as the stokers became larger and clinker grinders or other means of continuous discharge were made a part of the stoker, because water in quite large quantities was often needed to keep the rolls and grates cool. After several years of effort an ash gate which successfully collected and carried away all quenching water was developed and the construction of this gate is shown in considerable detail on page nine of our Catalog Number 1238. (Write for it.) Of particular interest is the fact that the tracks are upside down, that is, they run on the rollers rather than the rollers on the track. The water troughs which are part of the gate frames are also upside down, which means they are self-cleaning. The rollers are adjustable so that we are assured that the gate is in perfect alignment.

All of this development proceeded in gradual steps until hoppers and gates as shown on page two in Catalog #1238 became the standard. This illustration shows the sectional cast iron plate hopper with structural steel supports and a water collecting ash gate serving the hopper.

The ash gates were hand operated as shown in the illustration, or power operated as shown in later illustrations in the same catalog. The operating medium used in these cylinders was oil, water, air or steam. Naturally, oil is best because it is a perfect lubricant, expands slowly, making operation easy and smooth. Water was found to be next best; air next and steam poorest.

(Continued in November)

PORTRAIT OF A SOLDIER,

Written Specially for the Allen-Sherman-Hoff Company

BY

Lowell

He is known in the Air Force as Lanky Lucky, and his luck helped win him seven military decorations. And then he wound up in the guardhouse for wearing them.

He is not "bearded like the pard" nor yet "full of strange oaths." In fact, he is not full of words at all, good or bad—uses them as charily as a housewife spends her ration coupons. The depth of his yearning for "the bubble reputation" you may gauge from the fact that he no longer even wears his most important decorations, ever since they led to his paying a visit to the Guard House. Of that, more later.

When I met Aerial Gunner Charles Anderson there were four of us in a smoking compartment bound for North Carolina. With him was another lanky lad, from Milwaukee, who in temperament and disposition resembled Anderson only as a magpie is like an eagle. He went by the name of Double-jointed Bob, and his tongue was that way too. He referred to Anderson as "The Sarge." The Milwaukee boy had been "washed out" at a field in the Deep South, and what he thought of the training and the discipline was as rich in wordage as it was poor in sense. The Sarge had evidently heard it all so many times that he had become anaesthetized to it. At any rate, he sat silently looking out the window, with the immobility of a veteran. All he said was: "Stick around a while and maybe you'll learn something."

It took me several hours, and the help of voluble hints from Double-jointed Bob, to extract the outline of Anderson's Odyssey. He had acquired the nickname of Lanky Lucky, but at the time we met, luck was the element of which he had least. We might have had lots to talk about, since he came from Colorado, where I grew up. He was born in the Santa Anita country, one of the richest ranching districts in the West. Obviously of a high order of intelligence, he graduated from High School at sixteen and went to the University of Southern California, stayed there only a year, and while on the Freshman crew, was a friendly rival of young Jimmy Doolittle, Jr., son of the General with whom he one day was to serve in the air war over North Africa.

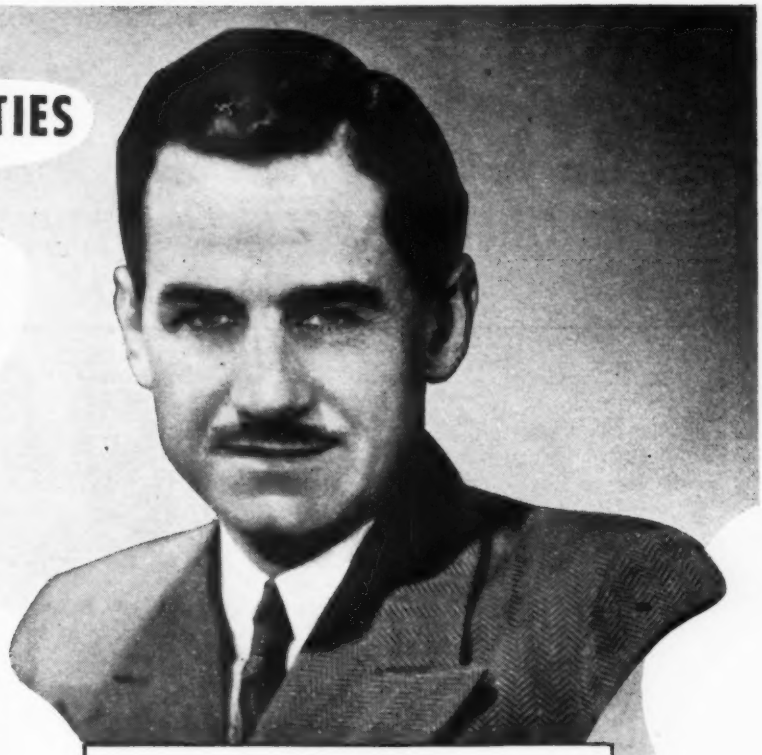
After his year at U.S.C., Anderson, still a lad in his teens, went to sea. (He is now only twenty-two.) If you told him that in going to sea he had betrayed a strong romantic streak, he would stare at you with disapproval. One time and another I have known many of the great adventurers of our time, and several who are, rest their souls, dead. All of them speak of romantically inclined people with the utmost scorn. And—all of them are full of it. Lanky Lucky shipped out on tramp freighters, sailing to the China Seas, India, Africa, Europe.

Three and a half years ago he enlisted in the U.S. Army Air Corps. There, as a Kiwi, with ground crews, he met many airmen, then subaltern, but now top rankers. His particular heroes were General Frank Andrews, who recently crashed in Iceland, and Colonel Alva L. Harvey. When Harvey was a sergeant he was

VINTAGE NINETEEN FORTIES

Thomas

The Story of "Lanky Lucky" whose Luck Ran Out



LOWELL THOMAS

Lowell Thomas, who has been broadcasting the day-by-day adventures of mankind without interruption for the past thirteen years, has had a varied and adventurous career. He was born in Ohio in 1892, reared in a Colorado gold camp, and has lived all over the world. As a young man he was a gold miner and cow puncher. Then he turned to newspaper work as a reporter and editor. After attending and receiving degrees from four universities, he became a member of the faculty of Princeton University.

As a speaker—before his radio days—he probably appeared in person before more people than any other man in the history of the platform.

As a traveler, he has led expeditions into the far north, into the tropics, and across remote sections of Central Asia.

He is the most widely known of screen commentators, and for the past ten years has been the Voice of Twentieth Century-Fox Movietone, the newsreel that has the widest circulation.

For thirteen (13) years now he has been the leading radio news commentator. By short wave and by broad wave his broadcasts circle the world.

junior pilot of the crew of one of the four Douglas bombers the Army Air Corps sent out to try for a first flight around the world. Major Frederick Martin, who piloted the plane of which Harvey was also the engineering officer, met a snowstorm over the Alaskan peninsula and ran into the side of a mountain. Alva Harvey and the Major were saved after twelve days of plodding through the snow. That ended their part on that First World Flight. But since then Sergeant Harvey, now a full Colonel, has gained fame on "The Mission to Moscow" flight, which he concluded by flying on around the world.

But to get back to Lanky Lucky Anderson. After Pearl Harbor he was promoted to Aerial Gunner. While on a patrolling assignment in the Caribbean, his first chance for distinction came one evening at dusk. The plane of which he was a crew member was ordered out when the bombardier happened to be off duty. So Lucky Anderson doubled in brass, as both gunner and bombardier.

Sure enough, they spotted the U-boat, on the surface, recharging her batteries. The plane dropped to masthead height, Anderson released his bombs—and scored a bull's eye. What's more, they took photographs to prove they had bagged the sub. For plotting the U-boat he was cited for the Silver Star—which he didn't get until a couple of years later. And by then he was with Doolittle, bombing the Axis in Tunisia and Sicily, and had earned several other decorations.

After taking part in some eighteen sorties, raiding Bardia and Tobruk, bombing Sfax, Sousse and Bizerte, harassing Axis shipping in the Mediterranean, and blasting airfields on Sicily and as far north as Naples—and picking up an African sickness—they gave him the option of going to Officers' Training School or becoming a pilot. He chose the latter.

And then it was that Lucky's luck ran out.

He had picked up a bug in Africa, some form of skin disease. Then on his way to a flying field in Alabama he caught Nashville flu and dropped in weight from 190 pounds to 140.

When he turned up for Pre-Flight he evidently was the first Air Cadet ever to show up wearing two rows of decorations, more than many a Major or Colonel in our fast expanding Air Force. Then, too, there had been cases of over-exuberant chaps wearing decorations that hadn't been earned. In such a case the ancient custom is to arrest first and investigate afterwards.

Aerial Gunner Charles Anderson had been in the air two thousand, two hundred hours; he had risked his life a score of times, had won seven medals. Madame Chiang Kai-shek gave him one of them after he had taken a plane crew overland five hundred miles to overhaul a plane in which she was traveling, in order to make it possible for her to continue her journey. Nevertheless, to the Guard House he went, and there he stayed while officers and clerks checked the records! When, of course, he was released with profuse and sincere apologies.

Then he became the victim of further irony. After three and a half years' service, though only twenty-two years old, he could not take the exhausting physical exercises. On one cross-country run, so tough it's nicknamed the Burma Road, his African malady proved his undoing. Each time before reaching the end of the Burma Road he would fall flat on his face and be out cold for an hour.

At last they gave him the choice of being "washed out" or of dropping out at his own request. Meaning that he would still retain a chance of being reclassified and of returning for another attempt to become a full-fledged pilot, after fully regaining his health.

And that was how I happened to meet him, on his way to a reclassification center.

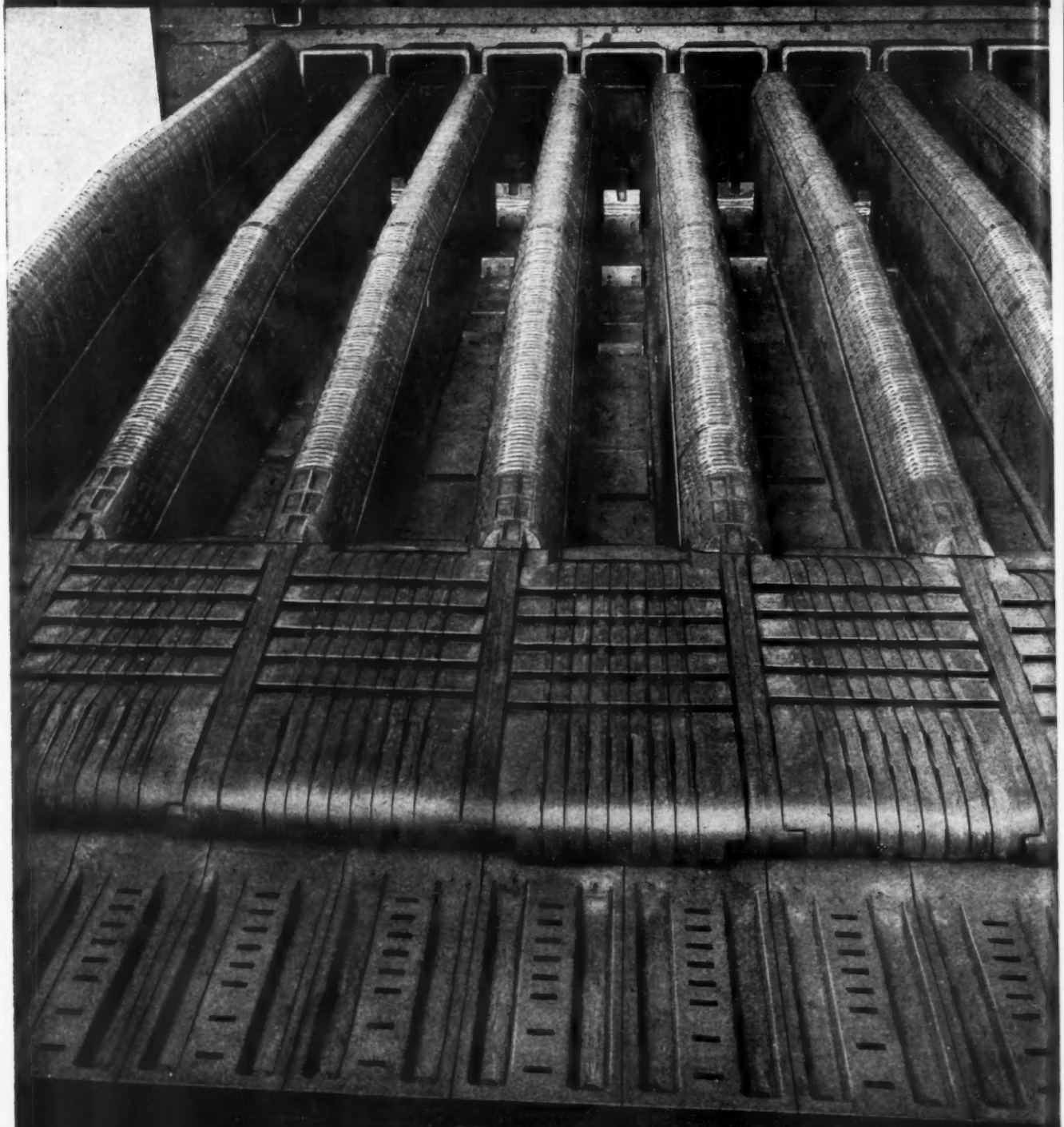
So surely it's time for Dame Fortune to smile on Luckless Lanky Lucky, time for his luck to return again.

ALLEN-SHERMAN-HOFF CO. 227 S. 15th STREET · PHILADELPHIA

OFFICES IN PRINCIPAL CITIES

Reduce Stoker

DETROIT MULTIPLE RETORT



DETROIT STOKER COMPANY General Motors Bldg. Detroit, Michigan

Absenteeism

STOKERS STAY ON THE JOB

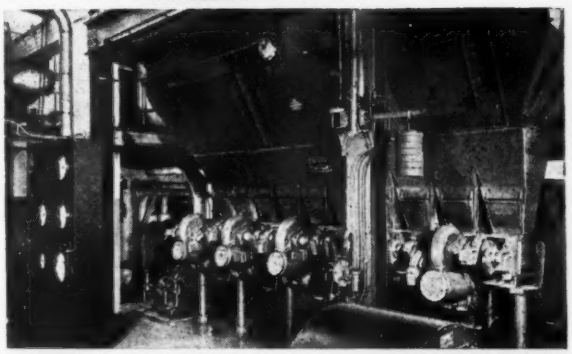
Detroit Multiple Retort Stoker

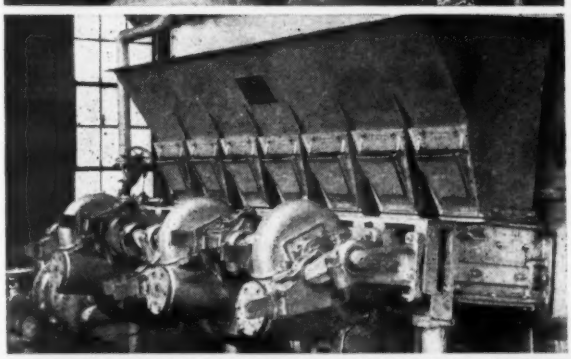
A stoker down for repairs is an ABSENTEE — and causes an ABSENTEE boiler.

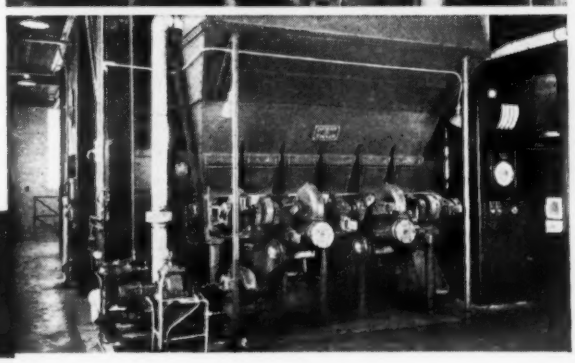
ABSENTEE equipment is a serious deterrent to war production.

Stoker ABSENTEEISM is negligible with Detroit Multiple Retort Stokers. Their great stability and endurance assure high availability.

Detroit Multiple Retort Stokers have made outstanding records in many plants. Write for Bulletin No. 130.







Works at Monroe, Michigan
District Offices in Principal Cities
Built in Canada at London, Ontario

23 years of steady, trouble-free service is record of MONEL trimmed main steam gate valves in Springdale Station, West Penn. Power Company

In 1920, four main steam gate valves with Monel stems, seats and discs were installed in the #1 steam header at the Springdale Station of the West Penn. Power Co. They were made by the Chapman Valve Manufacturing Co., Indian Orchard, Mass., per specifications of Sanderson & Porter, consulting engineers, and the Power Company.

A few years ago the steam header installation was changed. A new topping unit was added and the piping was altered.

The valves . . . which had already given constant, trouble-free service for about two decades . . . were put back in the line.

Today they are still in steady operation—after 23 years . . . with no attention except occasional renewal of the gland packing.

This service record is not unusual. It is a typical example of how Monel parts . . . installed by foresighted engineers long before the war . . . are now providing a "bonus" of long, trouble-free service for today's heavier power plant operation. The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

★ ★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

The RIGHT Instruments Help Get the Jump on TROUBLE

How Would You Handle these 3 Jobs?

1 **MOTOR LOAD** is being analyzed with a G-E portable inkless recorder. The test is made *without interrupting production,* simply by using a split-core current transformer (clamped around a lead in the control cabinet) connected to the recording ammeter.

2 **FEEDER CIRCUITS** are being checked with the G-E hook-on volt-ammeter. Both current and voltage are measured with just *one* instrument, simply by flicking the selector switch, first to AMPS and then to VOLTS.

3 **MOTOR-STARTING CURRENT** is being determined quickly by means of a G-E pointer-stop ammeter. An oscillograph could be used, but it is easier to use this instrument—particularly when there are a large number of motors to be checked.

These are typical examples of using the RIGHT instrument to get electric-circuit information in a hurry, without interrupting production. Have you the RIGHT ones for your preventive maintenance? This is particularly important if you have green hands in your maintenance department.

5 Instruments Will Do 90% of Most Testing Jobs

The G-E instruments shown below will handle most of your testing. Prices are for estimating only. For details, ask the nearest G-E office for the bulletins listed. If you need other instruments, let us know. *General Electric, Schenectady, N. Y.*

WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?

A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks —no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within ¾ of one per cent. Very portable—size only 2½ by 4¾ by 6½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by 3½ by 5½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

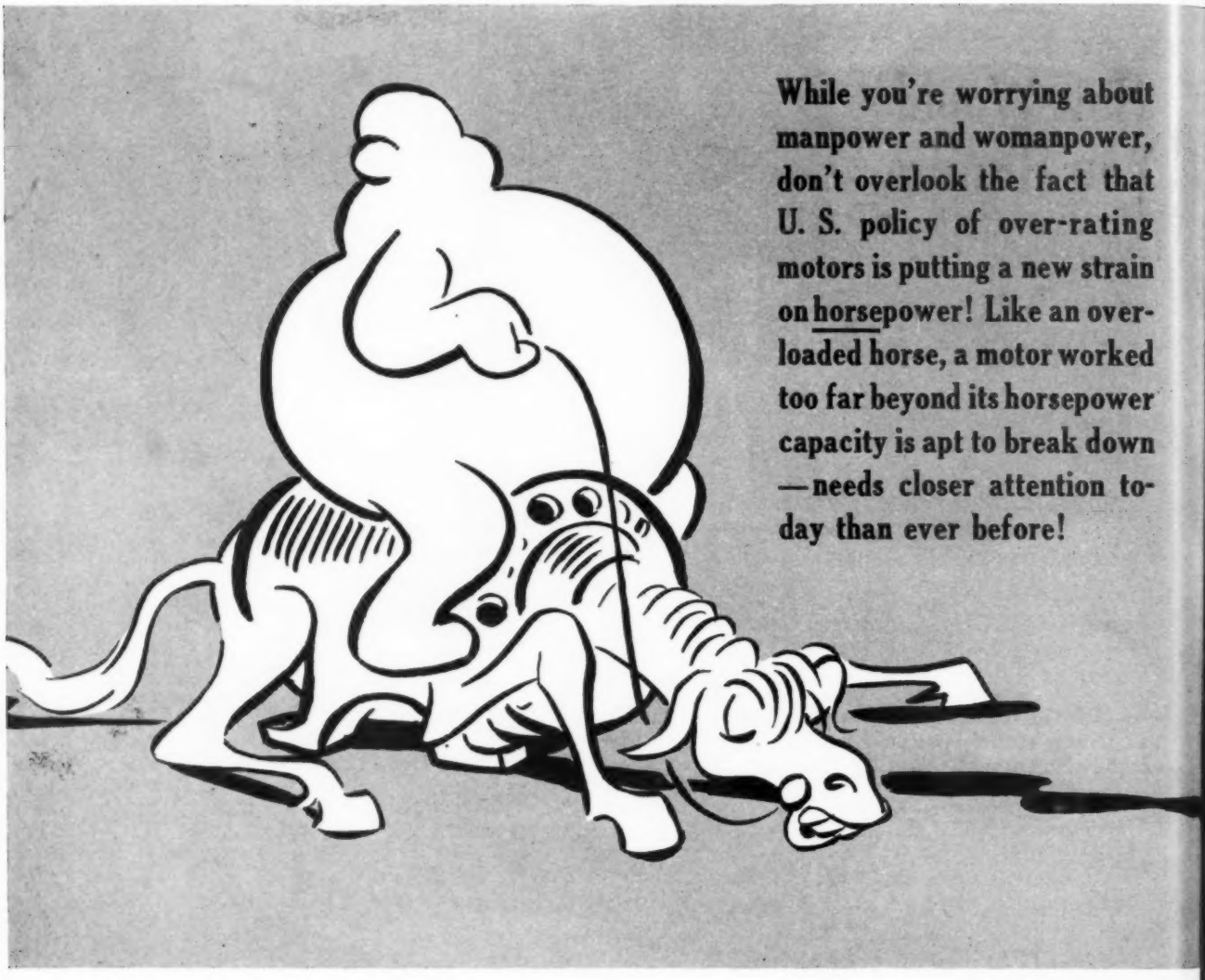
INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.

GENERAL ELECTRIC

602-42-6200

DON'T FORGET HORSEPOWER!



While you're worrying about manpower and womanpower, don't overlook the fact that U. S. policy of over-rating motors is putting a new strain on horsepower! Like an overloaded horse, a motor worked too far beyond its horsepower capacity is apt to break down—needs closer attention today than ever before!

WHAT WAS GOOD motor maintenance in peacetime, just isn't good enough today! Many motors are working *3 and 4 times* as many hours a week today . . . need wartime care . . . the kind set forth in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors." This interesting, *fully illustrated* book looks at motor maintenance from a *new* perspective . . . describes in detail the 9 main enemies of motor life . . . tells you where to look for them, how to fight them. To experienced men it will serve as a valuable "refresher" . . . to new employees, as a *valuable training course.*

Over 100,000 copies are in use by the armed forces and war industry. World-wide demand has necessitated Spanish and Portuguese editions! "Guide to Wartime Care of Electric Motors" is *free!* Write for your copy. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1639

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

The Transformer THAT MADE THE Load-center Unit Substation Possible

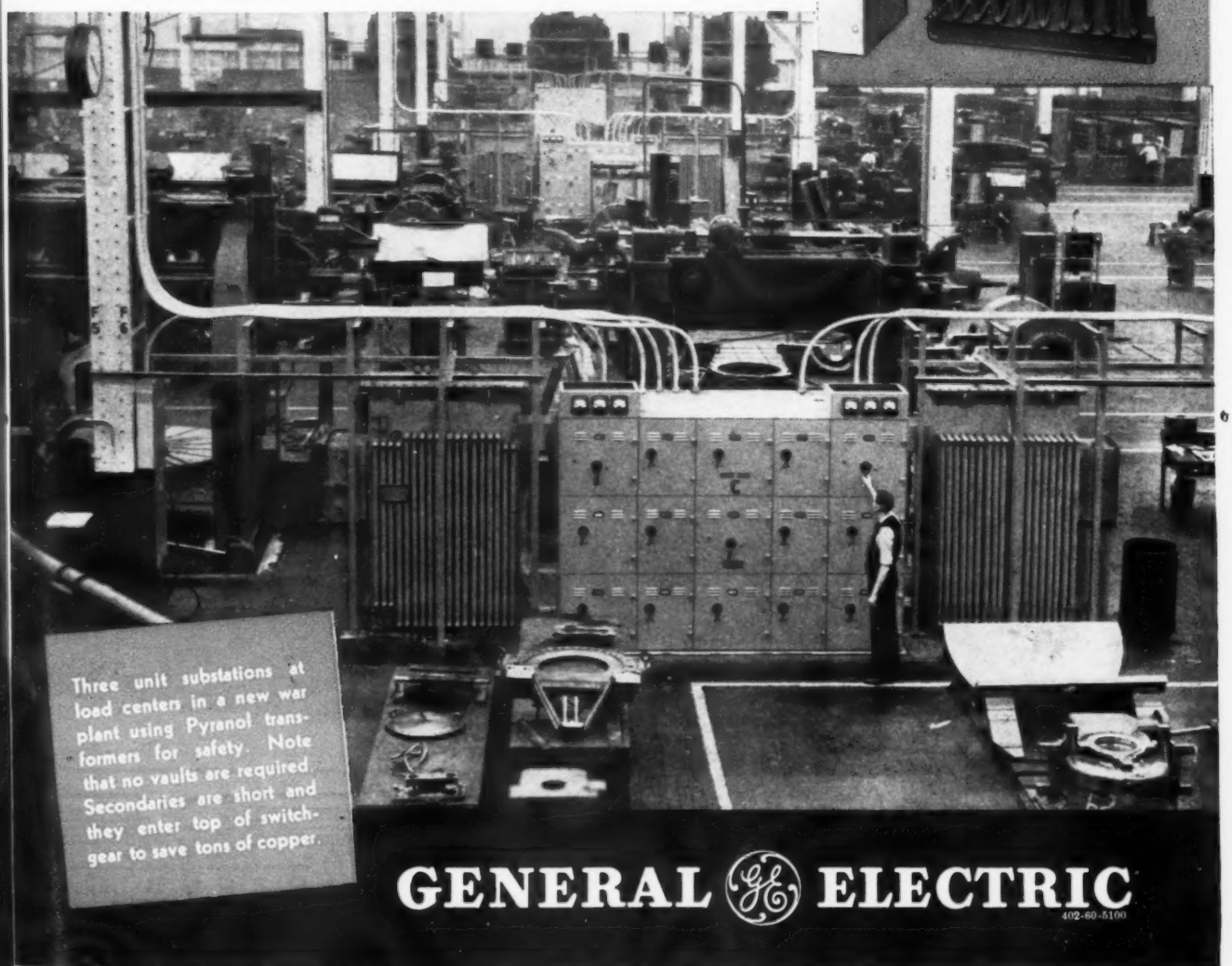
THE inherent safety of Pyranol* transformers led to the development of the modern load-center system of power distribution. It made possible the basic element of such a system, the load-center unit substation.

In turn, these easy-to-order, easy-to-install unit substations enable war plants to get rolling months sooner than would be possible otherwise. And because Pyranol transformers permit installation in or near the working areas, the elimination of long secondaries is saving thousands of tons of copper. Power losses are reduced, and voltage regulation is improved.

Remember, too, that Pyranol transformers are ***all-purpose*** units. Whether or not unit substations are called for, Pyranol permits installation anywhere you wish, indoors or outdoors, above ground or underground, in places wet or dry, clean or dusty. Whatever location you choose, these transformers will simplify your installation problem, and will supply the power for your war loads with little or no maintenance. Write for Bulletin GES-2974. ***General Electric, Schenectady, N. Y.***

*Reg. U.S. Pat. Off.

- - - the All-purpose PYRANOL TRANSFORMER for Safety and Savings



Three unit substations at load centers in a new war plant using Pyranol transformers for safety. Note that no vaults are required. Secondaries are short and they enter top of switchgear to save tons of copper.

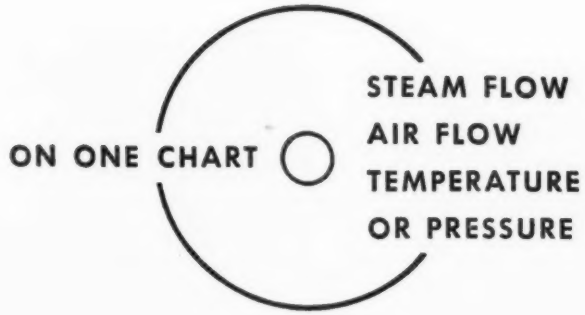
GENERAL ELECTRIC

402-60-5100

Announcing the

REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Boiler Meter



● The new Republic Boiler Meter provides, on one instrument and on one chart, all the essential information concerning boiler performance regardless of the size or type of boiler, kind of fuel or method of firing.

The meter indicates, records, and integrates steam flow from the boiler and records rate of air flow for combustion. When the correct amount of air for maximum combustion efficiency is being supplied the air flow pen will record coincident with the steam flow pen, regardless of the load being carried by the boiler.

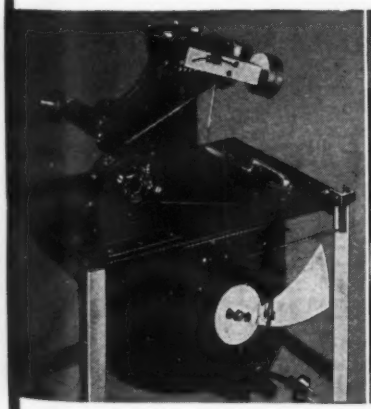
A third pen recording flue gas temperature (or steam pressure) can be added thereby providing the operator with complete information, on one 12-inch chart, relative to the performance of the boiler at any given time.

The Republic Boiler Meter is primarily a boiler operating guide. The two records, steam flow in red and relative air flow in blue, tell the operator instantly whether correct combustion and furnace conditions exist, thereby enabling him to correct faulty conditions when they occur.

The Republic Boiler Meter consists of a standard Republic electric steam flow recorder and integrator and an oil sealed, bell type air flow element.

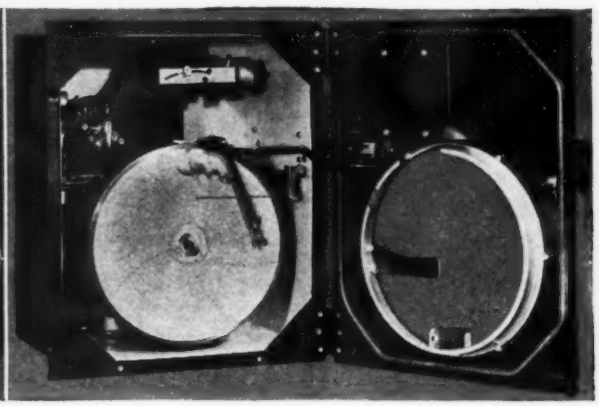
The air flow element consists of an oil sealed bell in a sealed chamber. The motion of the bell is transmitted through a diaphragm seal. This arrangement permits the use of a single bell—the high pressure being applied to the top of the bell and the low pressure under the bell. This arrangement also excludes air and dirt from the oil. The motion of the bell is transmitted to a cam system which extracts the square root, or when adjusted for a particular installation, compensates for chimney action and variable excess air requirements. The air flow pen is attached to the cam system with an adjustable linkage which permits changing the steam flow air flow ratio as conditions may require.

The entire operating mechanism is housed in a rugged steel case and can be easily removed as a single unit by merely loosening two anchor bolts and disconnecting the two air connections. The meter may be either wall mounted or flush mounted on a steel panel. *Write for Bulletin No. 420.*



Meter assembled as one unit on rack ready for calibration.

Meter assembly can be easily removed from the case.



Meter with door open showing accessibility of all adjustments and working parts.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago 47, Illinois

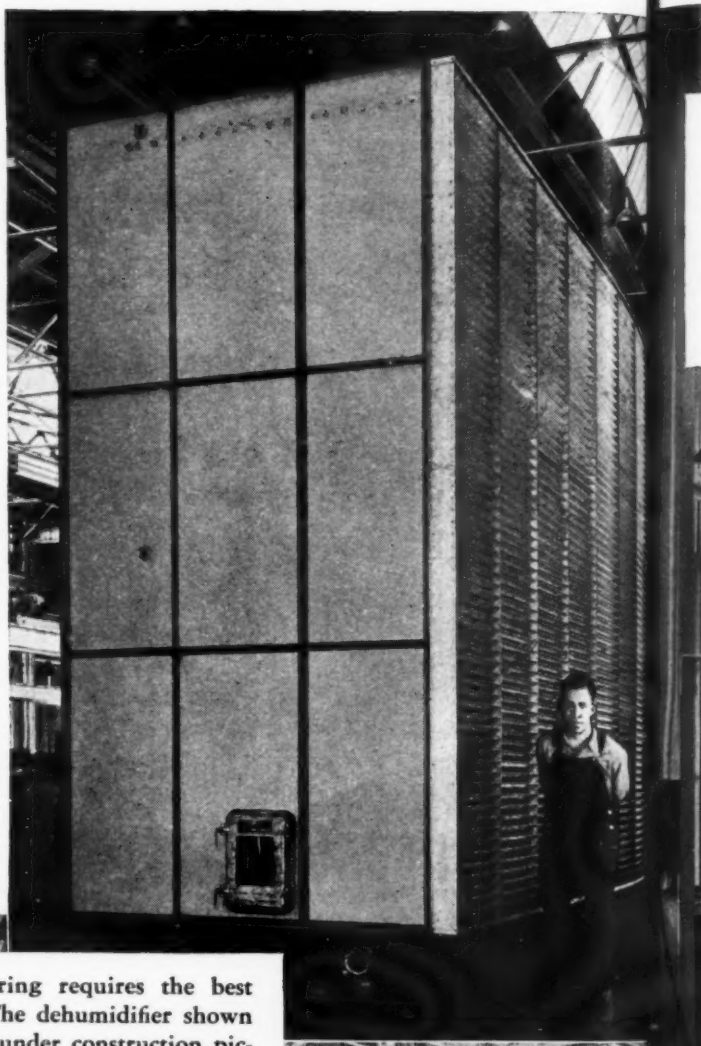
Progress and Power in the

In America's great aircraft industry which is producing at a record speed undreamed of in history, American Blower products are performing vital roles. Heaters for hangars, fly ash collectors for flying field heating plants, fans and dehumidifiers for air conditioning, heating, ventilating and distributing air in hangars, plane and engine plants, special equipment that makes possible revolutionary new processes, and even Fluid Drives for many of the planes themselves, are being produced in record quantities at American Blower's great factories. In the Public Utilities, whose plants are being taxed to capacity to furnish the load for the production of war materials, American Blower Mechanical Draft equipment, Collectors and Fluid Drives are meeting every test. Till Victory—making the machines of war hum is our job. After Victory—remember, you can always depend on American Blower equipment.

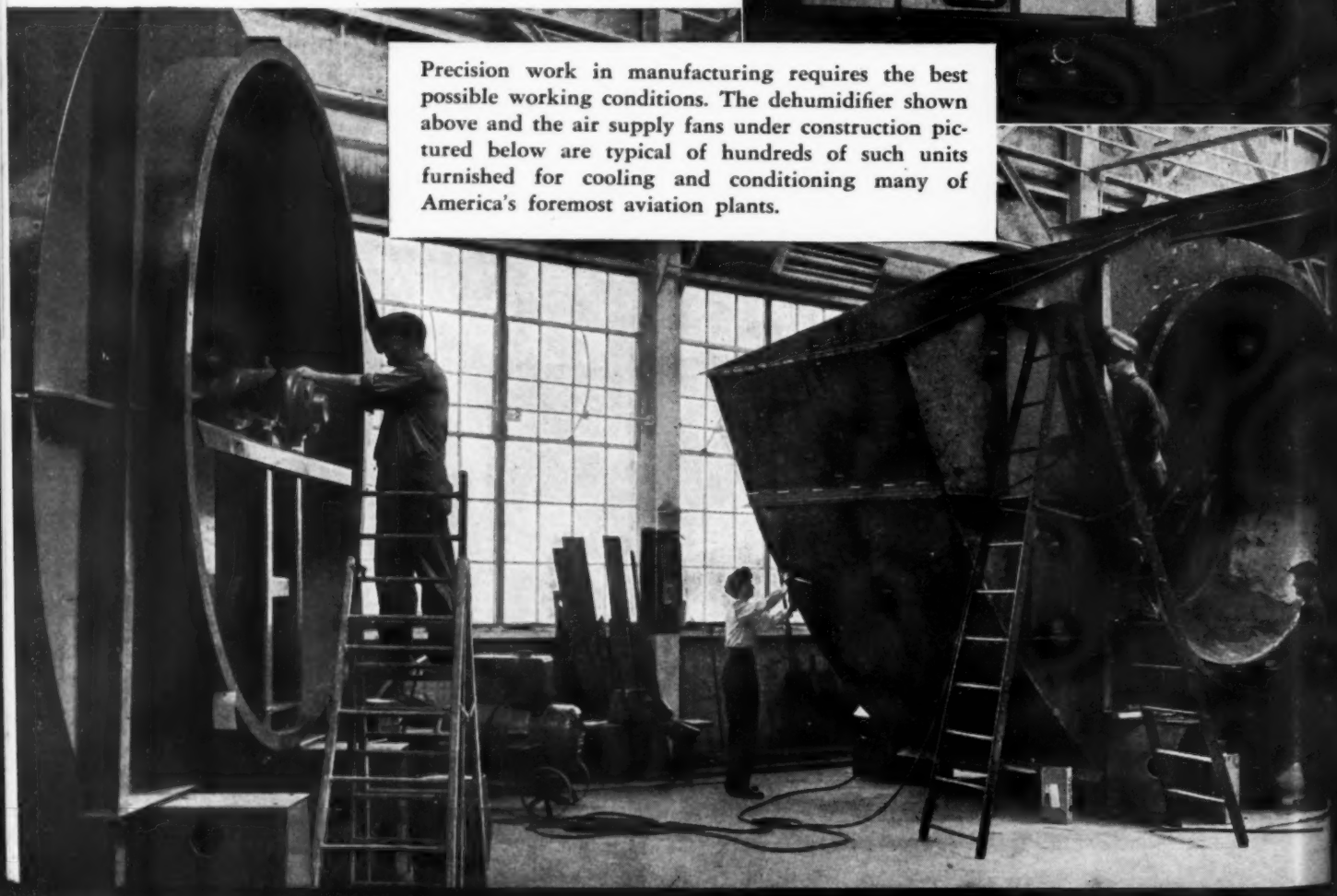
AMERICAN BLOWER

ARMY E NAVY
For Production "Well Done"

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
Division of American Radiator and Standard Sanitary Corporation

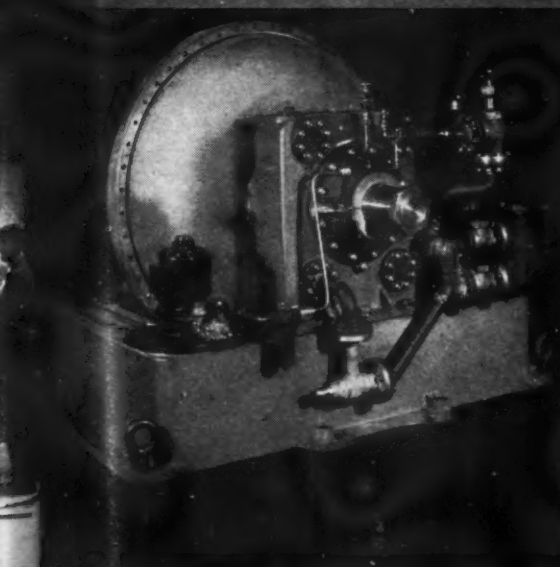


Precision work in manufacturing requires the best possible working conditions. The dehumidifier shown above and the air supply fans under construction pictured below are typical of hundreds of such units furnished for cooling and conditioning many of America's foremost aviation plants.



AIRCRAFT INDUSTRY!

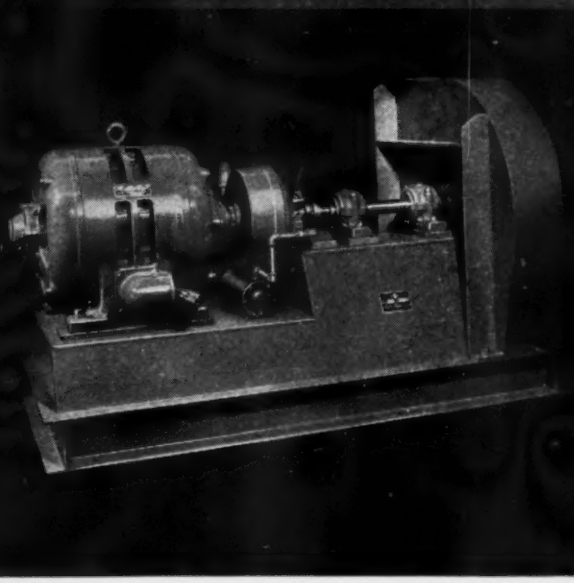
American Blower fans such as this one are used extensively in the aircraft industry for numerous testing purposes and to supply air at high velocity in wind tunnels.



American Blower Fluid Drives are performing many vital functions in the aviation industry. This particular unit (left) is one of many used for running-in and power testing aircraft engines.

• • •

The high pressure fan (right) with Fluid Drive Variable Speed Control is used to supply conditioned air to carburetors on test.



A LESSON IN WATER COOLING

LESSON 7 OF A SERIES

INDUCED DRAFT COOLING TOWERS OF HORIZONTAL DESIGN

Any product which consistently leads its field is generally the one which offers the most practical combination of all desirable features at least cost. In the case of mechanical apparatus, careful *designing* is necessary to coordinate the theoretical with the physical factors; and *users' experience* will invariably point out the design which does this best. Note the greater use of *horizontal* steam condensers. Also note the success of heaters, coolers, boilers and other heat-transfer apparatus that employ the cross-flow principle.

The horizontal type cooling tower employing horizontal air-flow is another example. It has won and held first place in its field through the past five years due to the simplicity and soundness of its basic design plus the general excellence of its physical characteristics.

Increasing the efficiency of evaporative water cooling equipment is a matter of accelerating the effective rate of heat transfer. Observe how the design of a horizontal type cooling tower accomplishes this by means of *perfected air-water flow.*

AIR FLOW

AIR VELOCITY: The uniform construction, both horizontally and vertically, of the air inlet louvers, the internal filling and the drift eliminators permits an even, straight-line air flow of uniform velocity for the *full travel* through the cooling chamber.

The fan suction chamber and drift eliminator design make possible the complete, equalized control of air velocity over the entire breadth and height of the cooling chamber.

AIR QUANTITIES: Greater air quantities with least draft loss are possible in horizontal cooling towers since the design permits (a) large and ample air passage through inlet louvers (b) large and ample air passage through the filling (c) large and ample air passage through drift eliminators (d) elimination of obstructions to air flow, such as internal systems for water distribution and baffles and filling laths set broadside to the air flow, and (e) elimination of air turbulence in general.

WATER FLOW

WATER DISTRIBUTION: Complete and uniform distribution of water over the entire cooling chamber is accomplished by evenly spaced nozzles located in the floor of the overhead water distribution basin. This uniformity of water coverage remains constant from top to bottom of the filling.

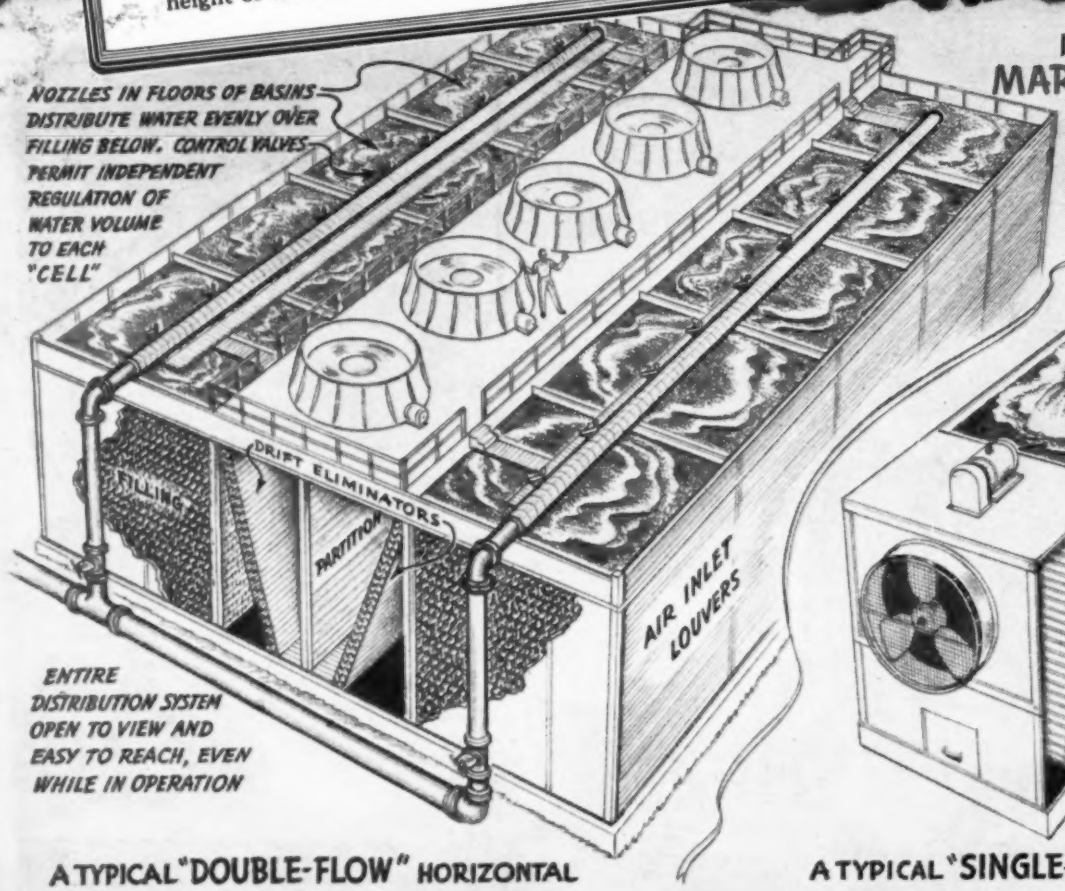
WATER SURFACE EXPOSURE: Initial break-up of water into fine droplets is accomplished by a diffusion deck directly beneath the discharge nozzles. On down through the cooling chamber the filling of staggered laths, on close centers both vertically and horizontally, provides a maximum of break-up and splash surface, a maximum effective wetted surface and minimum air restriction.

Not only does the horizontal cooling tower design achieve a maximum effective heat transfer rate by optimum air-water flow but it also incorporates many other noteable advantages such as

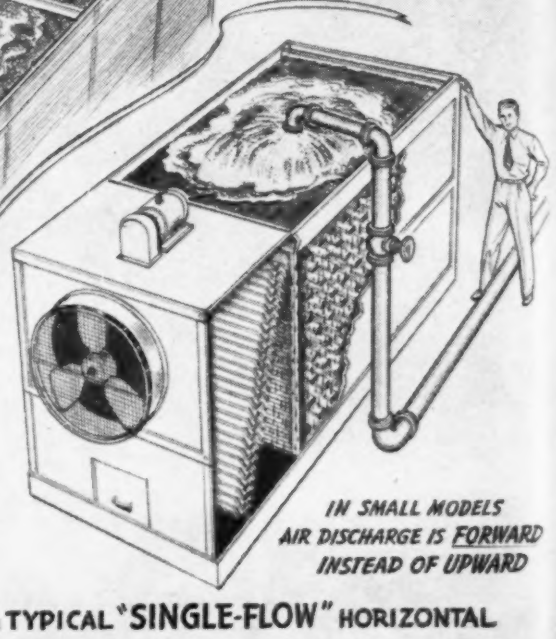
WATER DISTRIBUTION SYSTEM ENTIRELY EXTERNAL
PUMPING HEADS EXTREMELY LOW
BALANCED STRUCTURAL DESIGN, SIMPLE AND RUGGED
ALL PARTS READILY ACCESSIBLE
UNUSUAL OPERATING FLEXIBILITY
POSITIVE DRIFT ELIMINATION
APPEARANCE PLEASINGLY NEAT AND MODERN

IN ALL SIZES MARLEY HORIZONTALS

EMPLOY THE SAME SOUND PRINCIPLES OF WATER DISTRIBUTION AND AIR FLOW


NOZZLES IN FLOORS OF BASINS DISTRIBUTE WATER EVENLY OVER FILLING BELOW. CONTROL VALVES PERMIT INDEPENDENT REGULATION OF WATER VOLUME TO EACH "CELL"
DRIFT ELIMINATORS
FILLING
PARTITION
AIR INLET LOUVERS
ENTIRE DISTRIBUTION SYSTEM OPEN TO VIEW AND EASY TO REACH, EVEN WHILE IN OPERATION

A TYPICAL "DOUBLE-FLOW" HORIZONTAL



A TYPICAL "SINGLE-FLOW" HORIZONTAL

MOVEMENT OF AIR AND WATER IN THE THREE TYPES OF MECHANICAL DRAFT COOLING TOWERS

FALLING WATER — MOVING AIR

WATER IN

AIR IN

INTERNAL WATER DISTRIBUTION SYSTEMS RESTRICT AIR PASSAGE

HORIZONTAL FILLING LATHS ARE *BROADSIDE* TO THE VERTICAL AIR STREAM

AIR TURBULENCE

THE ABOVE THREE FACTORS MEAN HIGH DRAFT LOSSES AND NEEDLESSLY HIGH FAN POWER REQUIREMENTS

TYPICAL **FORCED DRAFT** TOWER

TYPICAL CONVENTIONAL **INDUCED DRAFT** TOWER

EXTERNAL WATER DISTRIBUTION — HENCE NO INTERFERENCE TO AIR FLOW

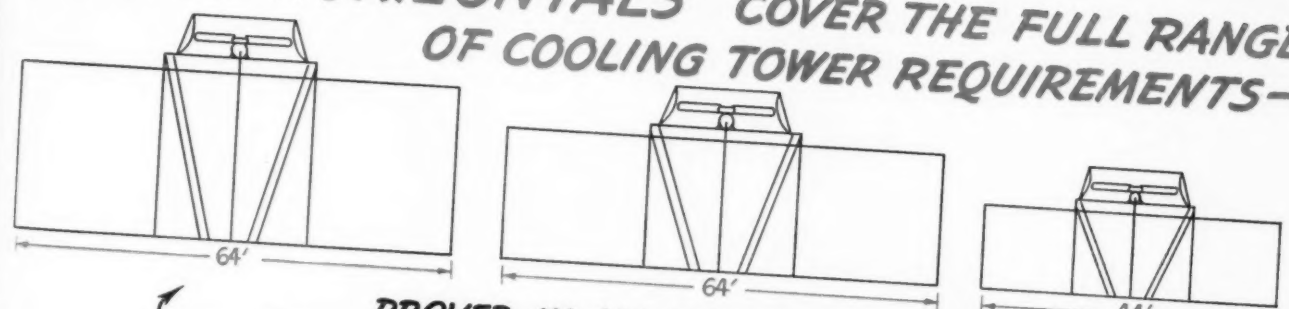
HORIZONTAL AIR STREAM FLOWS SMOOTHLY THROUGH THE HORIZONTAL FILLING LATHS

NO AREAS OF AIR TURBULENCE

THE MARLEY "DOUBLE-FLOW" HORIZONTAL INDUCED DRAFT TOWER

(DESIGN FULLY PROTECTED BY BASIC PATENT)

MARLEY HORIZONTALS COVER THE FULL RANGE OF COOLING TOWER REQUIREMENTS—

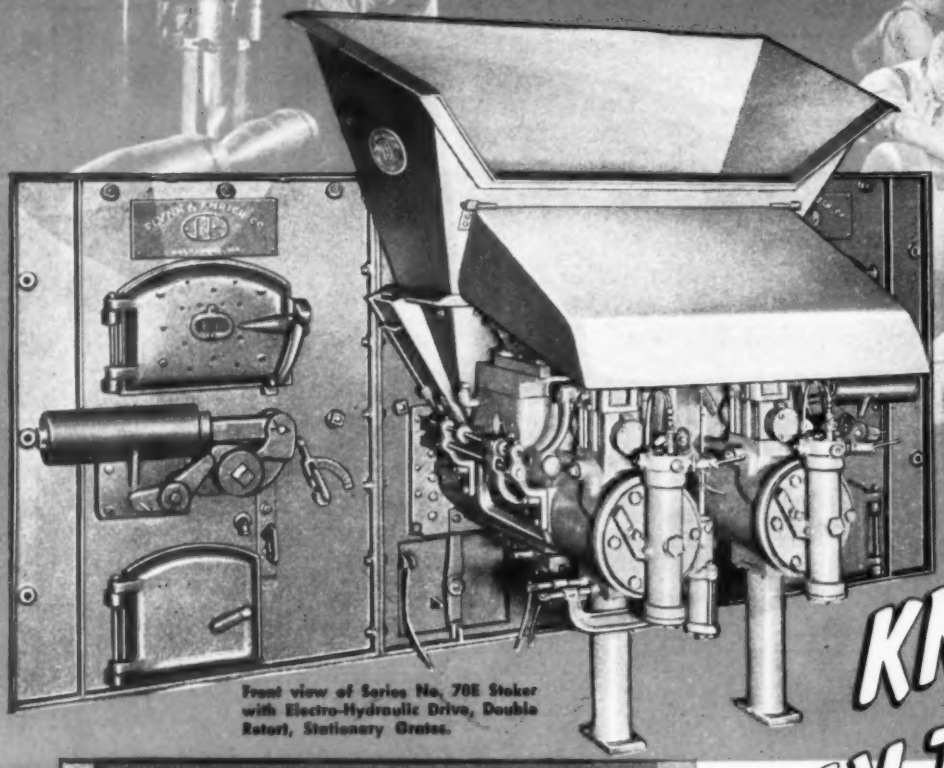


PROVED IN ALL KINDS OF SERVICES

LARGEST TO SMALLEST

MARLEY **COOLING TOWERS** THE MARLEY COMPANY INC. KANSAS CITY, KANSAS

73-A



Front view of Series No. 70E Stoker with Electro-Hydraulic Drive, Double Retort, Stationary Grates.

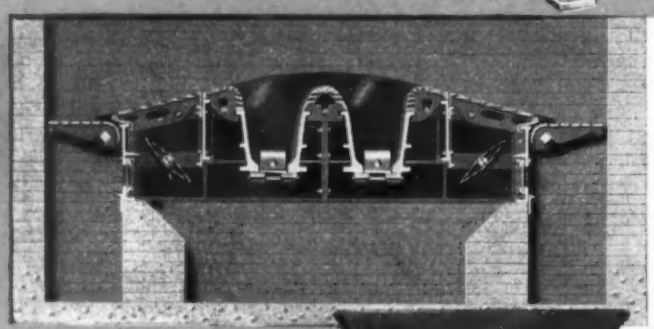
Horsepower has given America its superiority in Firepower. The flood of war goods streaming from war plants—large and small—is a tribute to those engineers who recognized that a dependable source of power was the answer to the battle of production for war—a foundation for sound post-war planning and a basic necessity for success in the coming competitive, peace-time markets.

KNEE-DEEP IN THE FIGHT

...BECAUSE THEY'RE DEPENDABLE

In hundreds upon hundreds of boiler rooms you will find "F&E" Underfeed Stokers on the job producing the Horsepower necessary to build engines and planes, tanks and guns, equipment and supplies for Victory. Day in and day out, they are proving their claim of Dependability.

The complete range of "F&E" Underfeed Stokers shown (1000 H.P. down to 24 H.P.) will satisfy the requirements of practically every boiler room. If you plan to convert to coal, if your boiler supplies heat or power, if your present production demands above-the-ordinary performance and if you are "post-war planning" then you will want to know just what an "F&E" Underfeed Stoker will do for you.



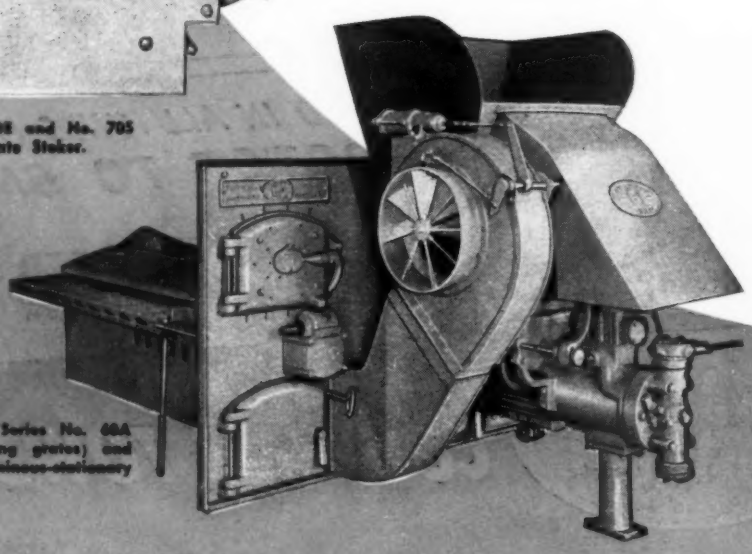
Cross section of the Series No. 70E and No. 70S Double Retort Stationary Grate Stoker.

Rear view of Series No. 70E and No. 70S Double Retort Stationary Grate Stoker.

★

These illustrations show the rugged construction and the operating principles that characterize "F&E" Underfeed Stokers.

★



Front view of Series No. 60A (Anthracite-moving grates) and No. 60B (Bituminous-stationary grates) stoker.

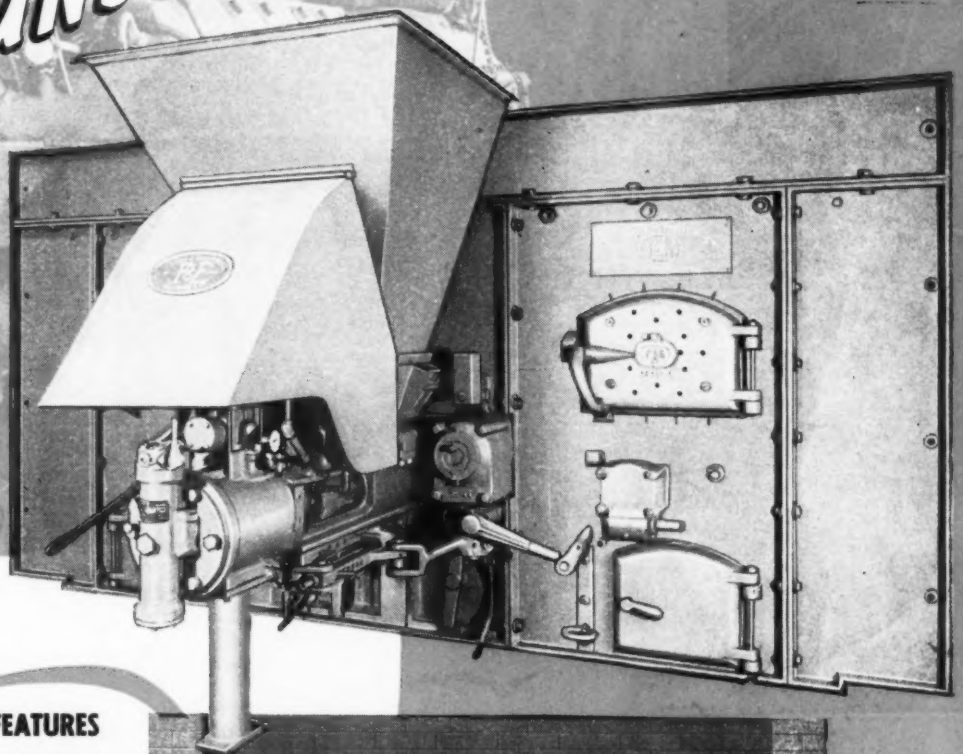
THE FLYNN & EMRICH CO.

Established 1842

BALTIMORE-2 • MARYLAND

REPRESENTATIVES IN PRINCIPAL CITIES

F&E UNDERFEED STOKERS



Front view of Series No. 70E Stoker with Electro-Hydraulic Drive, Single Retort, Moving Grates.

A COMBINATION OF FEATURES OFFERED ONLY BY "F&E"

1—Electro-Hydraulic Drive*

2—"F&E" Patented Interval Timer Governor

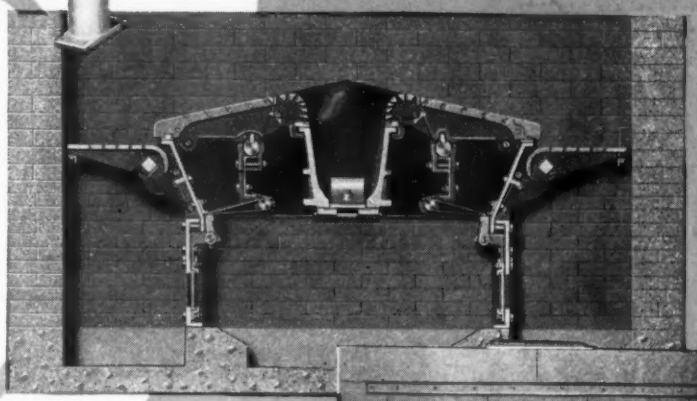
3—Fuel Bed Regulator

4—Sliding Bottom Retort

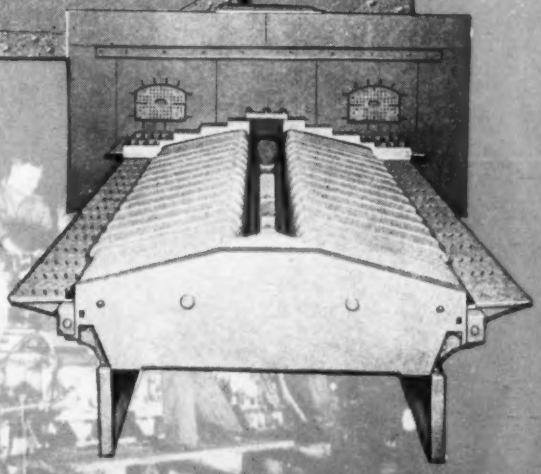
5—High Efficiency Tuyeres

6—Removable Ram Case Liner

**Steam Drive Available*

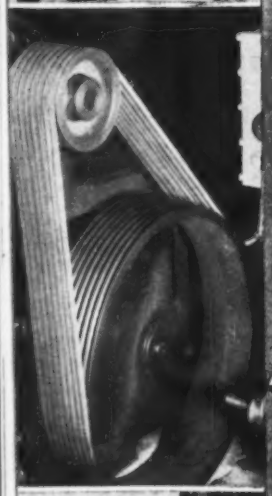


Cross section of the Series No. 70E and No. 70S, Single Retort, Moving Grate Stoker.



Rear view of Series No. 70E and No. 70S, Single Retort, Moving Grate Stoker.

Front view of Series No. 40A (Anthracite-moving grates) and No. 40B (Bituminous-stationary grates) stoker.



MANHATTAN

FLEXLASTICS

Condor PRODUCTS

- Conveyor and Elevator Belt
- Compensated Belt
- Transmission Belt
- V-Belt
- Air Hose
- Contractors Hose
- Fire Hose
- Hydraulic Hose
- Oil and Gasoline Hose
- Sand Blast Hose
- Steam Hose
- Suction Hose
- Water Hose
- Chute Lining
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- Abrasive Wheels
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THROW YOUR SCRAP INTO THE SCRAP!

KEEP AHEAD WITH MANHATTAN

FLEXLASTICS

WHAT THEY MEAN TO YOU IN INDUSTRIAL RUBBER SERVICE . . .

Here is a name full of meaning—a vital, manifold meaning, the importance of which is stressed and highlighted by war and scarcity.

MANHATTAN FLEXLASTICS* are of over 1,000 kinds—each accurately compounded of one or more forms of "manufactured" and natural rubber with different ingredients in correct proportions and then given its ultimate qualities by closely controlled processing.

Rubber compounding is an art, seasoned with scientific research, development and controls. To formulae must be added the skill and experience of the processor. "Rubber goods made only of rubber would be as useless as a cake made of nothing but flour."

It is from long practice of this art that the three essential qualities have been built into MANHATTAN mechanical rubber goods. These essential and inclusive qualities are *flexibility, elasticity* and *lasting service.* Together, they are embodied in FLEXLASTICS*—a term which aptly and fittingly describes the various types of "rubber" which are used in making such MANHATTAN products as flat power transmission belts; V-belts; conveyor belts; steam, water and air hose; fire hose; oil-well drilling hose; rubber covered rolls; rubber linings for processing tanks, piping and equipment; and a myriad specialties used on aircraft, ships, war and production equipment.

The long list of achievements like Condor Compensated Belt, Homo-Flex Hose, Homocord Belt, the Extensible Tip for endless belts, Radio-Active Treated Fire Hose and many others illustrate how well MANHATTAN has applied the art of rubber making. Some of these developments, available to industry only after Victory, will be important factors in the shifting tide of production.

It will always be sound policy to keep ahead with MANHATTAN.

50 YEARS OF RESEARCH

1893 — **1943**

Only the name is new. Back of FLEXLASTICS is a half century of engineering and chemical research and experience which combine the skilled application of FLEXLASTICS with properly located* strength members *for long-lasting service from natural, reclaimed and "manufactured" rubbers.*

*Compounding of the several types of "manufactured" and natural rubbers with other ingredients and processing them to obtain the required chemical and physical qualities is another important contribution by MANHATTAN to the comprehensive advantage you will obtain from FLEXLASTICS.**

**The term FLEXLASTICS is a Manhattan Trade Mark. Only MANHATTAN can make FLEXLASTICS.*

THE MANHATTAN RUBBER MANUFACTURING DIVISION

of RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES — PASSAIC, NEW JERSEY

WHY TWO DEVICES?

ONE CAN DO THE JOB

COMBINATION STARTER

Gone are the days when you had to buy a separate device for each function of motor control. Now, whatever your plant's operating conditions, you can get *combination* control. This means a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit. Look:

50% reduction in mounting time
Mount only one device, not two.

40% reduction in wiring time
Connect to only 9 terminals, not 15. The switch and starter come already connected.

Increased safety
Cover cannot be opened while there is power on the starter.

Reliable motor protection
Protection devices co-ordinated in starter at the factory.

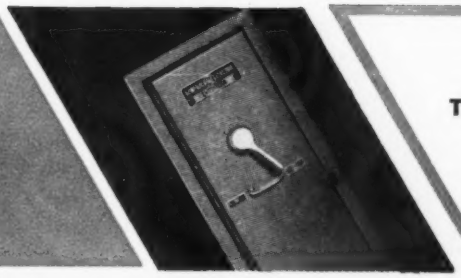
Saving of wall space
The one device takes less space than two.

Improved plant appearance
Single, streamlined case — less open wiring and conduit.

Look over the selection on the next page—and then mail the coupon for more information about the G-E combination starter best suited for your job.

GENERAL ELECTRIC

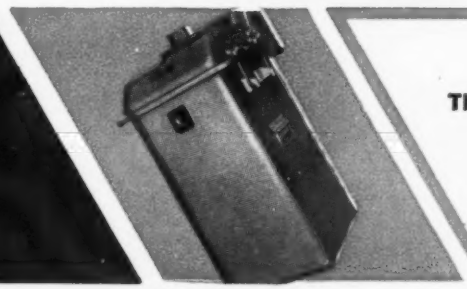
GENERAL PURPOSE



THE TYPE 1 ENCLOSURE is suitable for general-purpose, indoor applications where atmospheric conditions are normal. Available up to and including NEMA size 5.

INFORMATION IN BULLETIN GEA-3715

CORROSION-RESISTANT



THESE STARTERS are made in two forms—one for corrosive atmospheres (Type 3) and one for hazardous locations (Type 8). All arcing parts and terminals (of forms for hazardous locations) are at least six inches under oil.

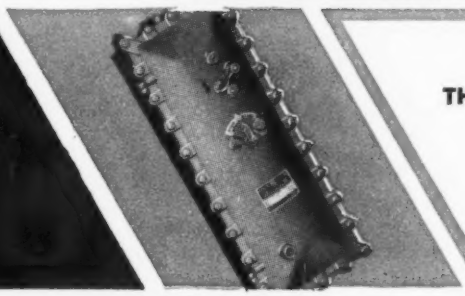
INFORMATION IN BULLETIN GEA-3541

DUST-TIGHT

THE TYPE 5 ENCLOSURE is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.

INFORMATION IN BULLETIN GEA-3715

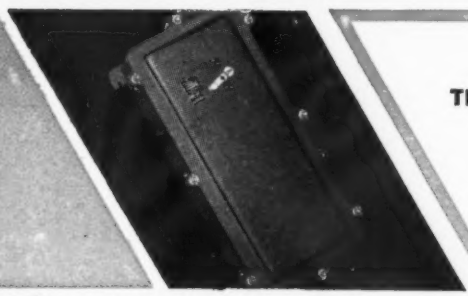
OR HAZARDOUS LOCATIONS



THE TYPE 7 CASE for Class I, Group D, locations is made of cast, high-strength alloy. These starters are designed to withstand internal explosions. The flanges, which are securely bolted on all sides, are grounded to tolerances that will not permit the escape of hot gases.

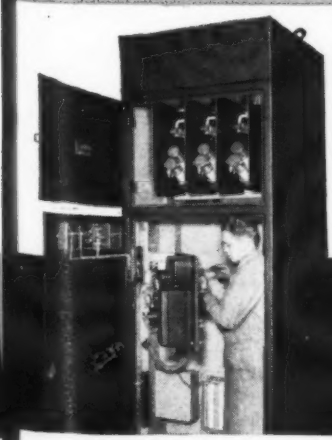
INFORMATION IN BULLETIN GEA-3804

WATERTIGHT



THE TYPE 4 CASE is suitable for outdoor use, and for damp places indoors, such as dairies, breweries, and ship docks. The cases are of cast iron, or fabricated boiler plate, with a special weatherproof finish and corrosion-proof fittings.

INFORMATION IN BULLETIN GEA-3715



NEW HIGH-VOLTAGE COMBINATION

This recently developed combination starter provides split-cycle protection and starting means for 2300- and 4000-volt motors.

INFORMATION IN BULLETIN GEA-3660

BUY WAR BONDS

Which of these bulletins may we send you?

General Electric Company, Section 676-95B
Schenectady, N. Y.

Please send me the publications checked below.

- ☐ GEA-3715 — General purpose, dust-tight, watertight
- ☐ GEA-3804—For hazardous locations
- ☐ GEA-3541 — Corrosion-resistant
- ☐ GEA-3660—For high-voltage service

Name.....

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City..... State.....

8920

if we do our part back home!

Our Navy will give 'em the works, if we'll give 'em all we've got back here in America. That means working a *full* week *every* week . . . it means no unnecessary driving . . . it means conserving materials . . . and it means that we must all buy War Bonds regularly. Let's all do our part today and every day until the war is won!

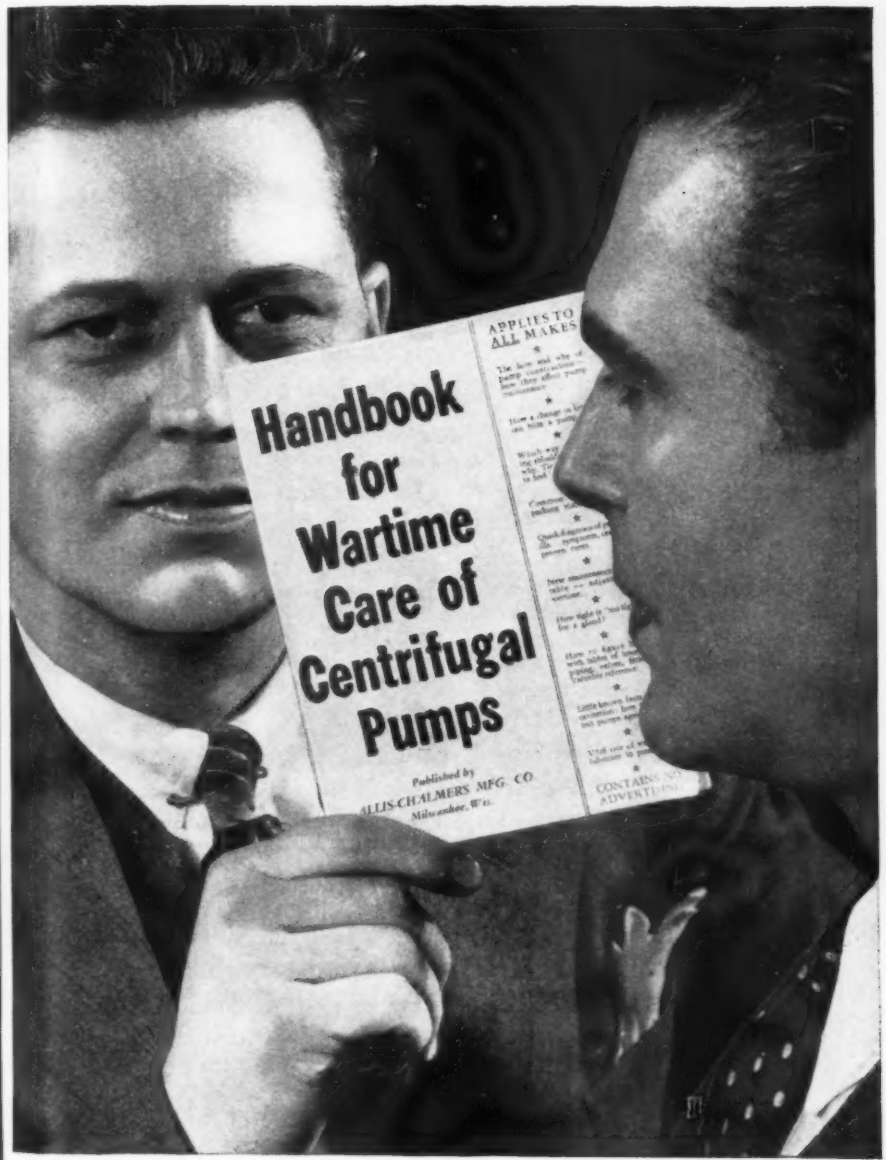
Garlock

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Manufacturers of GARLOCK Packings, Gaskets and KLOZURE Oil Seals

In Canada: The Garlock Packing Company of Canada Limited, Montreal, Que.

Pump Book Makes News!



Contains no advertising— applies to all makes — copies mailed free of charge. Use it to make present pumps last. And when you *do* need new pumps, look into the extra efficiency, ruggedness and long life of Allis-Chalmers centrifugal pumps — the famous "Electrifugal" . . . and all types for every purpose.

ALLIS-CHALMERS MILWAUKEE

WE WORK FOR VICTORY · WE PLAN FOR PEACE

HOW TO MAKE EQUIPMENT WORKING ROUND THE CLOCK LAST IS INDUSTRY'S MOST DISCUSSED SUBJECT. MOST DISCUSSED BOOK IS A-C'S NEW PUMP MAINTENANCE GUIDE!

NOW THAT PUMPS are working 2 and 3 times as many hours a week as in peacetime, *they need wartime care* . . . the kind set forth in Allis-Chalmers new "Handbook for Wartime Care of Centrifugal Pumps"!

By building a pump on paper, this new handbook takes a *fresh* look at pump anatomy. Contents include new preventive maintenance tips, a guide to spotting trouble, a new *war* timetable for pump care, valuable tables. Tear out the coupon below and send in now for *your* free copy!

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* a copy of your "Handbook for Wartime Care of Centrifugal Pumps".

(Name)

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(Street Address)

(City and State)

A-1582

How you can help yourself to Better Boile

Your Reliance Boiler Safety Equipmen and observance of simple precaution prevent water level accident worry

IT isn't easy for Reliance, like many other manufacturers these da to supply new equipment to industry. Most of our production water columns and accessories goes to do important jobs on boilers armed service outposts all over the world, and to boilers of the Unit Nations. Thousands of marine water gages for war and cargo vess take further toll of production time. That's why it takes a little longer deliver certain items for industrial installations.

But you can help yourself to better water level supervision by taking easy steps. First, survey carefully your present equipment and put it the best condition possible. Perhaps the suggestions on the oppos page will help. Secondly, place orders now for repair parts or min additions needed to maintain your present equipment at its best. The parts are available from stock on your MRO priority. Third, *plan* m any major change or addition which is needed to provide perfect wa level supervision. Consultation with our district service representati may enable you to select the very best arrangement and plan its futu delivery for convenient installation.

When you specify a Boiler Water Column, demand:

1. Design, material, and welding to meet ASME Code requirements.
2. Water level alarms sensitive to ¼″ water level movement.
3. Dimensional size to meet the individual needs of your boiler.
4. Water gage vertical, inclined, or periscope vision, as you wish.
5. Construction and workmanship such that maintenance will be abs lute minimum.

When you specify a Remote Reading Water Level Indicator, demand:

1. Hydrostatic operation to eliminate all mechanical working parts.
2. Use only one indicating fluid, which must not mix or react with wat
3. Factory calibration for your specific application, eliminating pos bility of tampering in service.
4. Positive and reliable accuracy of water level reading.
5. Similarity of appearance to conventional boiler gage glass, for e comparison.

Only Reliance can meet ALL your requirements.

Since 1884

Reliance

Water Level Supervision

TO BOILER ROOM MEN:

These "don'ts" mean do keep on your toes to protect vital power production

DON'T permit dirty gage glass to remain in use, thereby offering chance of reading false level.

DON'T be a "gage cock twiddler" . . . open gage cocks *wide* and permit a thorough blowoff before closing, to prevent excessive wear.

DON'T let the high or low alarm whistle blow too long or too often . . . remember it's intended for an *emergency* and the warning should be heeded as such.

DON'T attach any device to water column piping that requires an appreciable flow of steam or water . . . under penalty of creating false water column level.

DON'T fail to observe carefully the speed at which water returns to correct level after blowdown, to determine whether gage valves are unobstructed.

DON'T permit drain valve leakage in line from gage glass, as such leakage may create false water level.

DON'T let gage glass illumination become non-effective because of dirt, incorrect lamp or lack of adjustment. Good vision is cheap insurance against costly repair bills.

DON'T permit valves in piping between water column and boiler drum unless they meet code requirements and can be locked or sealed open.

DON'T let any inoperative or inaccurate water level indicating device remain in service without a prominent warning sign to guard against its use. Remember the other fellow on the next shift!

DON'T fail to keep all boiler water level gages and indicators in first class repair. Their vital responsibility demands top priority in maintenance.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

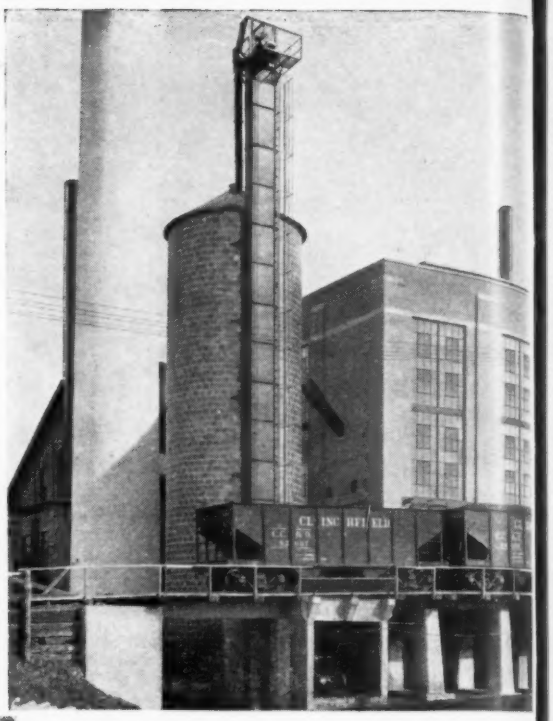
FUEL OIL HAS GONE TO WAR

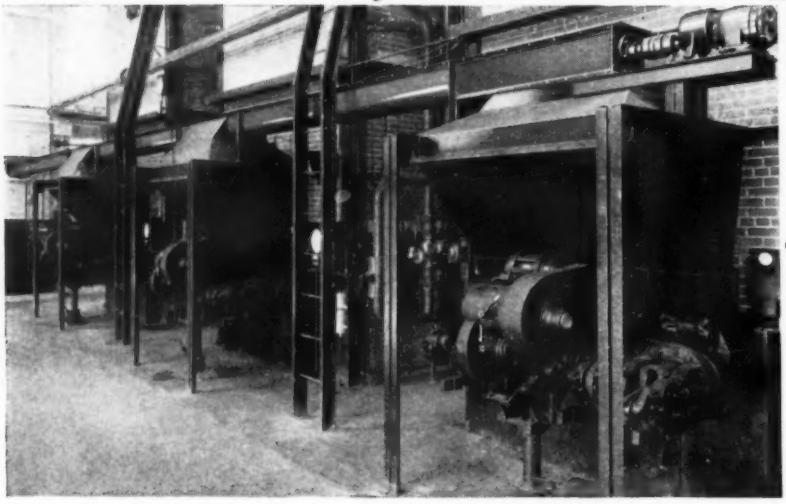
★

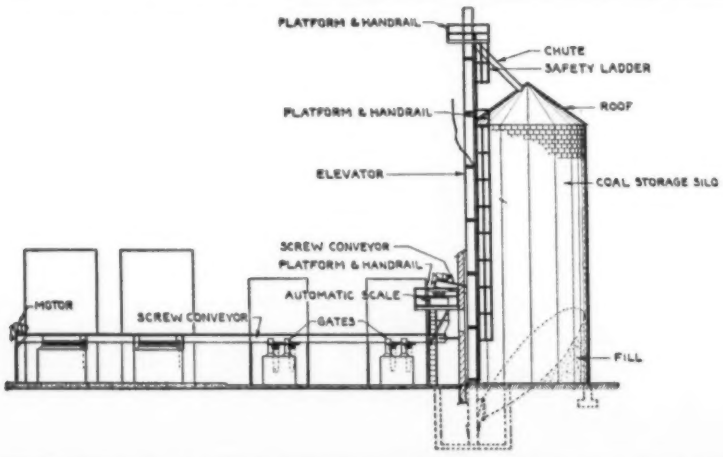
ENGINEERED CONVERSION TO MEET YOUR SPECIFIC NEEDS

• Perhaps you have limited storage space for coal—or you require a system of handling which provides some outside storage in addition to a silo—or you may need two silos to meet your operating conditions — whatever your plant needs you'll find the answer in

The FAIRFIELD SILO SYSTEM







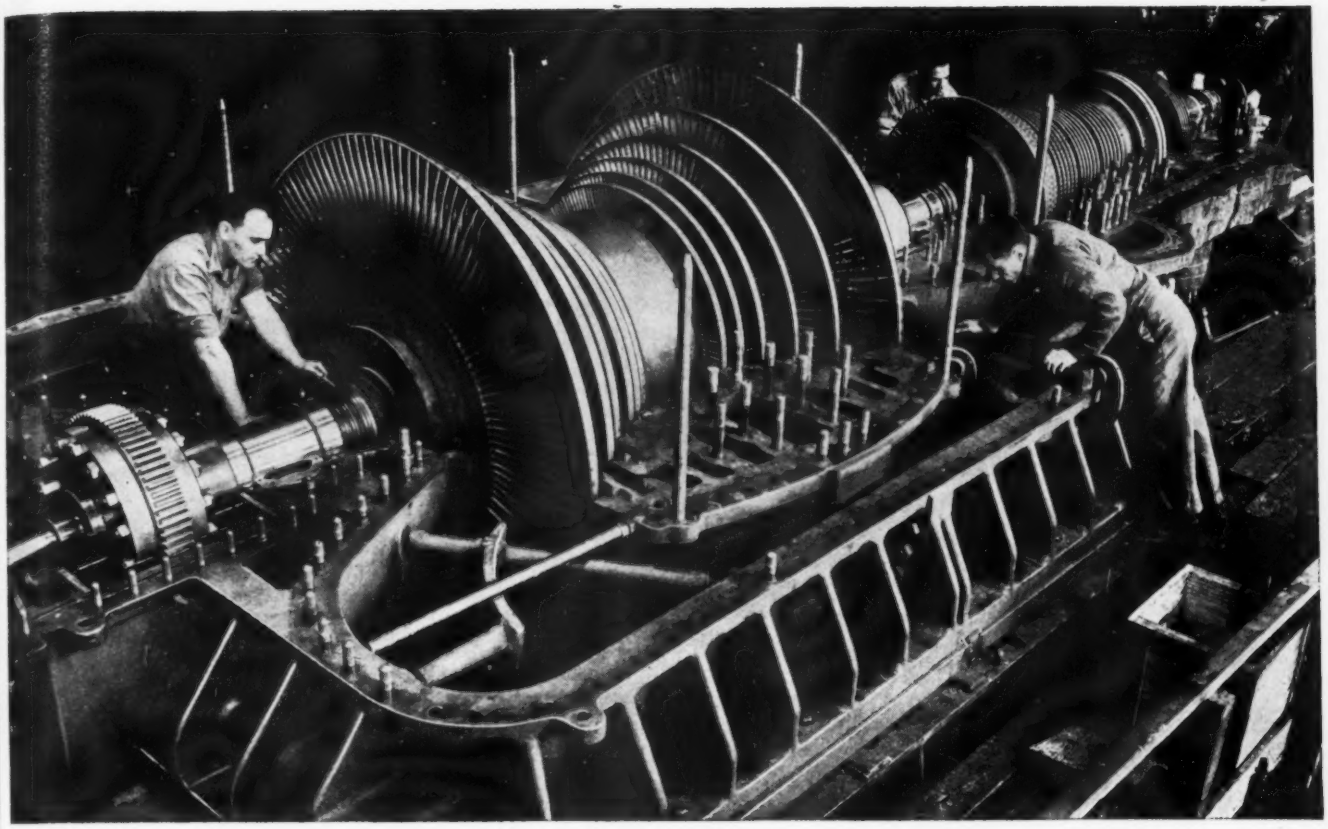
• The Fairfield method includes complete storage and handling of coal from car to stoker or pulverizer. It will be engineered to meet your operating conditions.

The Silo is made of vitrified tile—is moisture proof—and prevents coal from freezing. It will store 100 tons in a 12 ft. dia. space and 500 tons in 24 feet diameter.

A wide variety of successful installations are described and illustrated in our catalog. Look them over, they may suggest an answer to your coal conversion problem. We will gladly send a catalog at your request or will be pleased to have one of our engineers call and go over your plant with you. Write—Wire or Phone for an interview.

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT



Stainless Steel Turbine Buckets

Don't Get The "Creeps"

The life of a steam turbine bucket is not easy. Superheated steam strikes against the bucket with such force that, in some cases, it whirls at a rim speed of 600 miles per hour. The combination of high heat from the steam and centrifugal stresses from the speed will cause most metals to grow, or "creep." But if a turbine bucket creeps even a few thousandths of an inch in its limited clearance, it renders a turbine useless.

Most metal buckets travelling at such speeds will pit and erode under impact of the steam and the droplets of condensed water.

When the turbine bucket is made of stainless steel, the story has a different ending. *Stainless steel turbine buckets resist creep, pitting, and erosion to give dependable service over a long period of time.*

We do not make stainless steels, but we produce chromium and other ferro-alloys that give steels their strength and toughness. Our metallurgists have a background of over 35 years' experience with alloy steels, both in the laboratory and in the field. If you have a problem in the selection or use of an alloy steel, consult us.

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade Mark
Ferro-Alloys & Metals

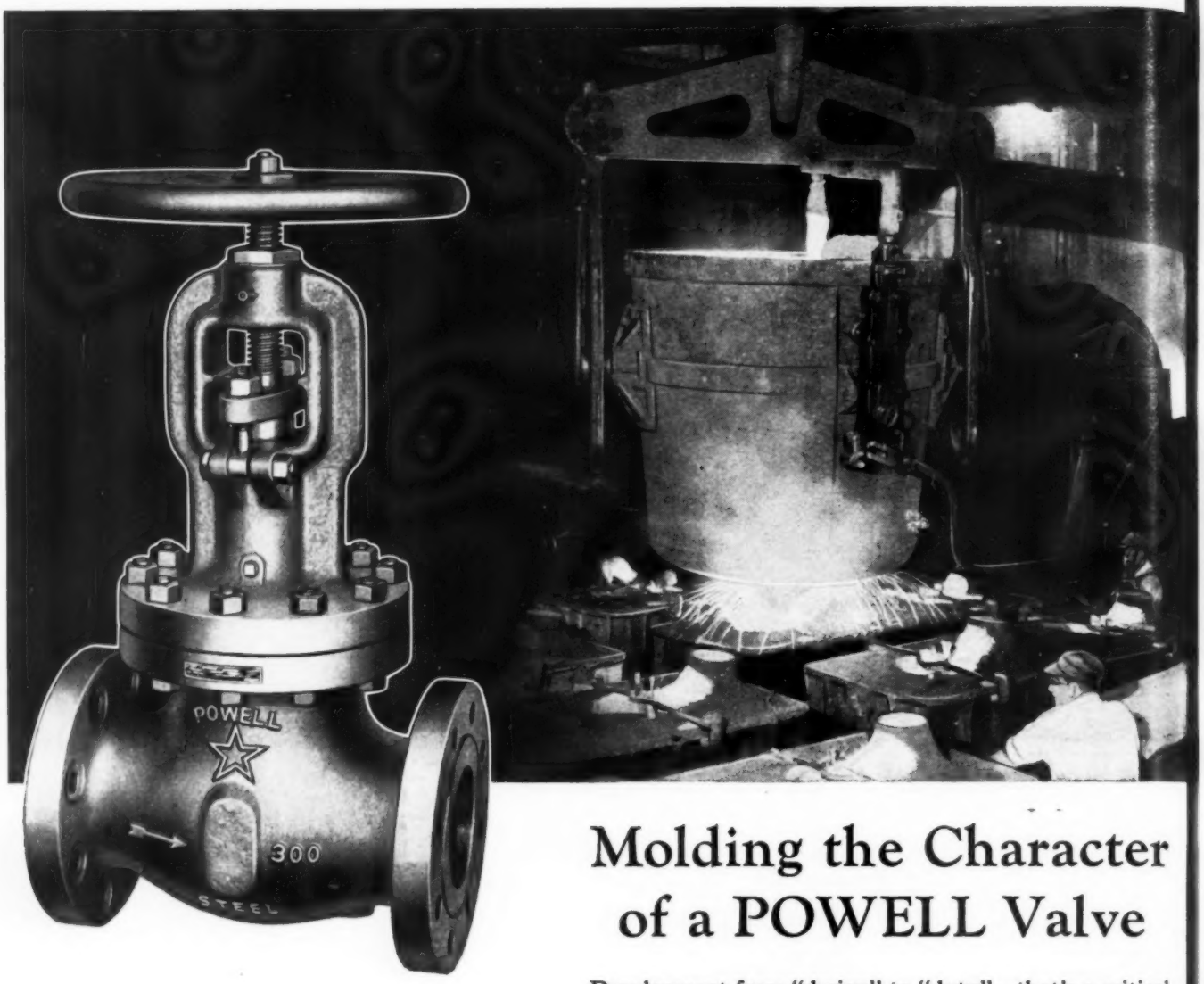


Fig. 3031—A Class 300 pound flanged end Cast Steel Globe Valve with outside screw rising stem and bolted flanged yoke. Made in sizes 1″ to 10″, incl. 8″ and 10″ valves are regularly furnished with anti-friction bearing yoke and spur gears.

POWELL CAST ALLOY STEEL VALVES, for high pressure service, meet A. S. M. E. and A. P. I. Standards. They are made from regular cast steel valve patterns and are especially adapted, and used extensively, for high temperature, high pressure steam and high pressure boiler feed water lines. The designs also meet A.S.M.E. Boiler Code requirements. They are made to A. S. A. dimensions in the following pressure classes: 150, 300, 600, 900, 1500 and 2500 pounds.

Molding the Character of a POWELL Valve

Development from "design" to "duty"—that's a critical stage in the life of a valve. In our foundries, Powell Valves, whether of bronze, iron, steel, pure metal, or special alloy, take on the form and substance that Powell Engineering has pre-determined will best fit them to perform the duties for which they are destined. Here under the watchful care of experts are molded the characteristics that have earned for Powell Valves the designation "Standard for Control." That's why today many industrial leaders are turning to Powell for the solution of all their valve control problems.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

POWELL

The complete POWELL Line includes Globe, Angle, Gate, Check, Relief, Y, Non-Return and other types of valves in bronze, iron, steel, pure metals and special alloys to meet the demands of all branches of Industry for DEPENDABLE FLOW CONTROL EQUIPMENT.

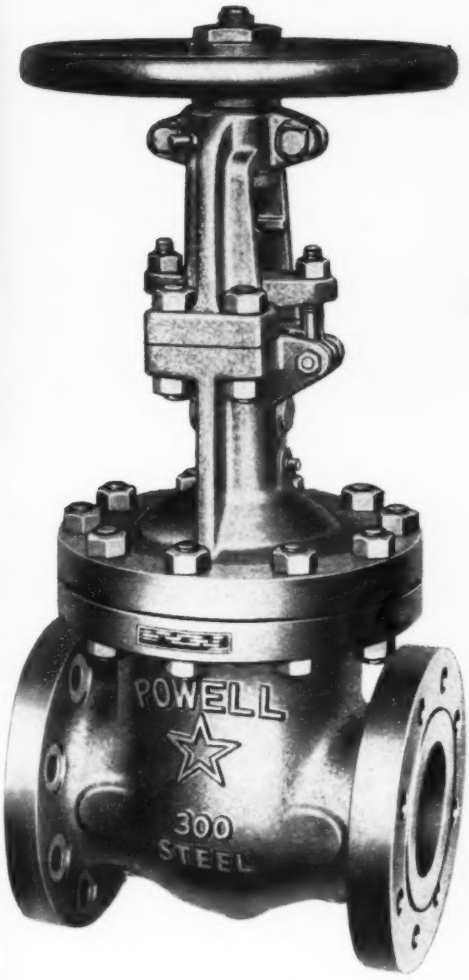
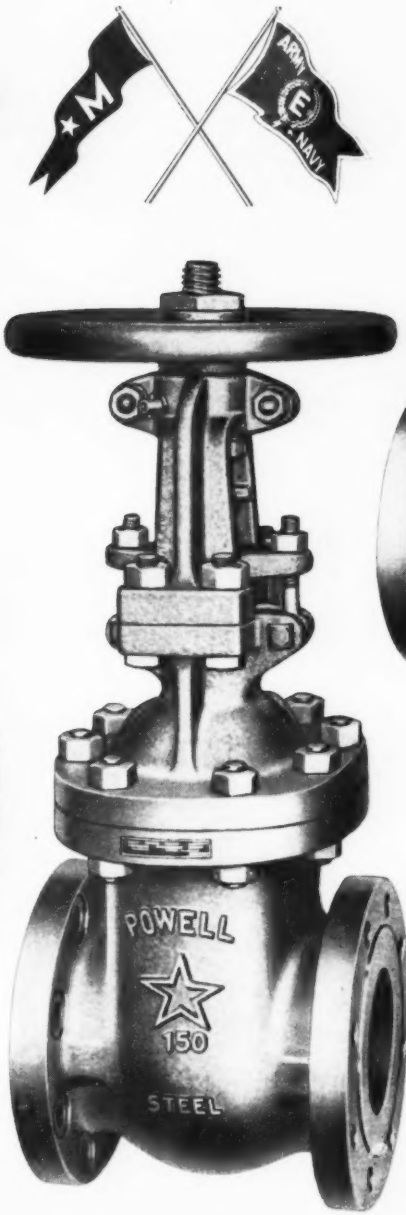


Fig. 3003—A Class 300 pound flanged end Cast Steel Gate Valve with outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Made in sizes 1″ to 24″, inclusive.



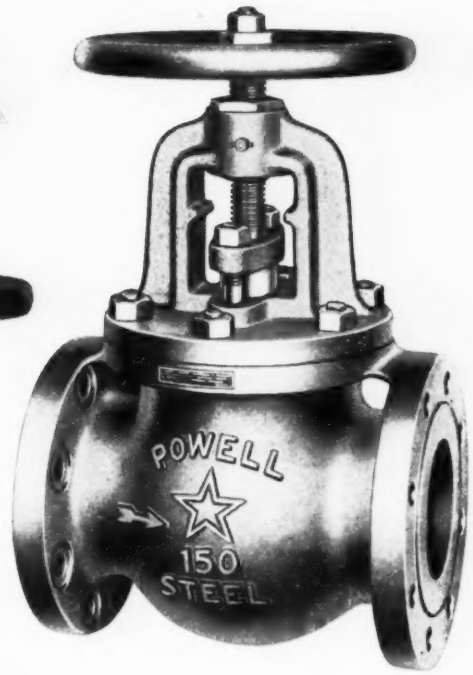


Fig. 1531—A Class 150 pound flanged end Cast Steel Globe Valve with outside screw rising stem and bolted flanged yoke. Made in sizes 1″ to 12″, inclusive.

Fig. 1503 (Left)—A Class 150 pound flanged end Cast Steel Gate Valve with outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Made in sizes 1″ to 24″, inclusive.

VALVES

Testing is Your Protection

90,000 cu. ft. per min. turbine-driven blast furnace blower on test in De Laval Works

The De Laval Testing Division, which is operated as a separate department by competent men who devote their entire time to testing, is of benefit to purchasers of De Laval equipment in two ways:

1. Testing gives assurance that the apparatus meets guarantees as to efficiency, head or pressure, volume or capacity, etc., and that its mechanical operation is satisfactory.

2. The results of tests on each machine enable the De Laval designing engineers to improve and perfect the product.

Where apparatus must be built for a great variety of operating conditions, as in the case of steam turbines, centrifugal pumps and compressors and rotary pumps, a consistent policy of testing is particularly important.

M-26

DE LAVAL *Steam Turbine Co.* **TRENTON 2, N.J.**

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC; PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER; PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL; and FLEXIBLE COUPLINGS

SEPTEMBER 1943

POWER

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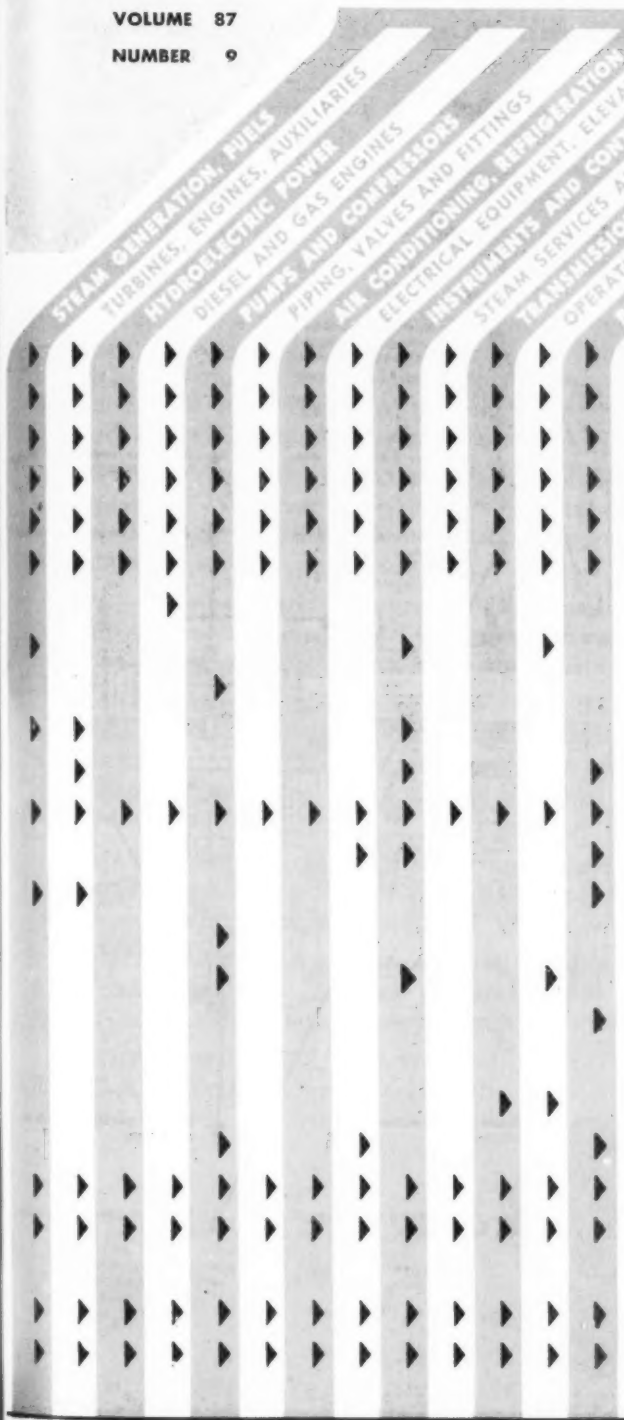

Cover from a painting by Peter Helck, courtesy The Dow Chemical Company, parent organization of Dowell, Incorporated

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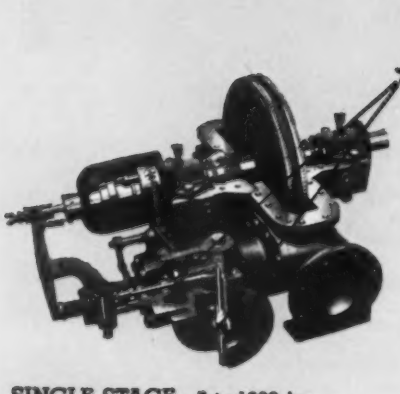
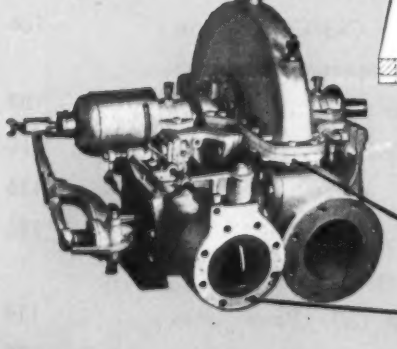
intermittent

OR . .



SINGLE-STAGE—5 to 1000 hp 1000-5000 RPM—Type C turbine, cutaway to show Dual Protection mechanism. For steam conditions through 600 lbs. ga. 750° F inlet, 50 lbs. ga exhaust



★ **DUAL PROTECTION** Overspeeding trips both valves at once

★ Shrouding secured by spun blade tenons

★ Chrome-alloy blades

★ One piece disc, shrunk and keyed onto shaft. Protected by corrosion-resistant paint. Rotor balanced dynamically

★ Generous number of carbon rings

★ Cored water chambers for oil cooling

★ Sparkless overspeed trip, with Micarta insert

★ Powerful, sensitive governor

★ Steam path contoured for efficiency

★ No soft packing on inlet valve stem

★ Ground horizontal joint—no gasket

★ Heavy-duty hand valve with bolted bonnet

★ Steam strainer about inlet valve

★ Heavy construction

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

continuous duty

There's More for Your Money in Turbines from Steam Headquarters

Broadly speaking, mechanical drive turbines in a refinery fall into two classes, according to their assignments. Some are called upon for the 24-hour-a-day steady pull of a continuous duty drive . . . others are idle much of the time.

ALL TYPES OF TURBINES are included in the Westinghouse line. There are low-cost Type C single-stage units, 5 through 1000 hp, and types C-225 and C-325—larger multi-stage turbines that combine low first cost with added steam economy, for capacities through 1500 hp . . . Type CH heavy-duty, single-stage, built for high-pressure, high-temperature operation from 50 to 2000 hp . . . and Type M multi-stage turbines, up to 5000 hp, for high-efficiency service.

SIMPLIFY TURBINE SELECTION by coming to Steam Headquarters. Whatever the job . . . continuous or intermittent duty . . . Westinghouse Turbines operate safely, economically, reliably.

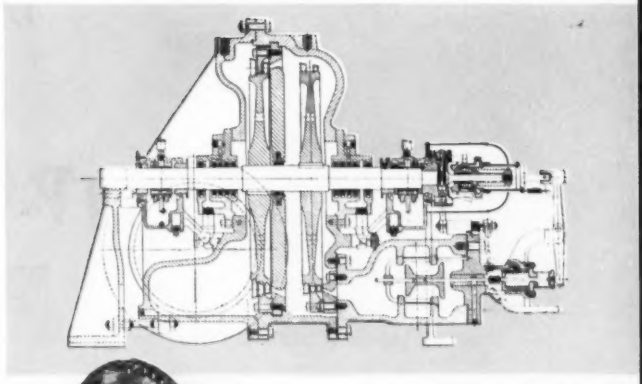
SAFE—Overspeeding is prevented. On Types C and CH, Dual Protection trips shut ***both*** the governor valve and the butterfly valve ***simultaneously,*** in event of overspeed.

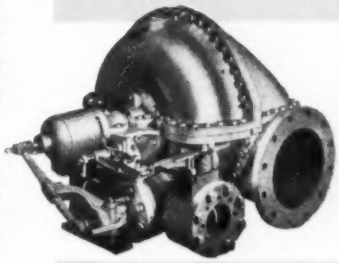
ECONOMICAL—Blading proportions are the result of extensive research. Blade pitch is uniform. Blade shrouding is made conical to approximate the steam expansion characteristic. Nozzle dimensions are accurate. All this adds up to maximum steam economy.

RELIABLE—Fully protected against corrosion and erosion. Blades and shrouds are chrome-alloy. No soft packing is used on the governor valve stem.

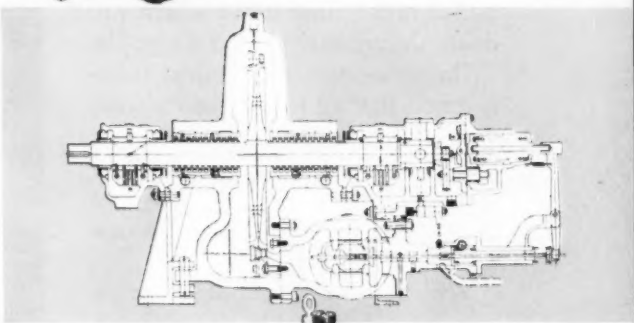
MAINTENANCE HELP is as convenient as your telephone. A national organization of steam experts is ready at all times to help you keep your steam equipment up to par.

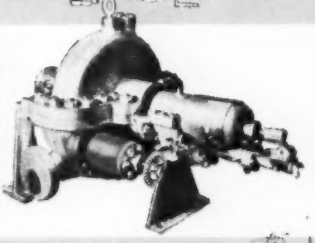
SEND FOR THE BOOK YOU WANT—
B-2230-A on Type C Turbines. B-2175 on Type M.



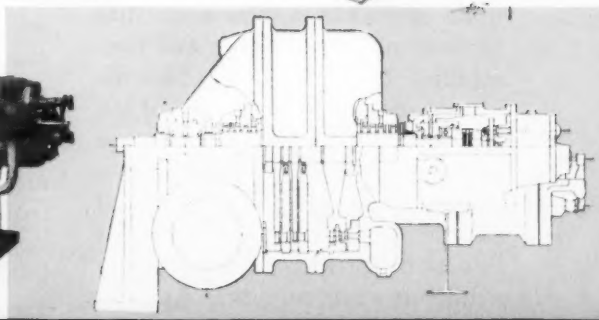


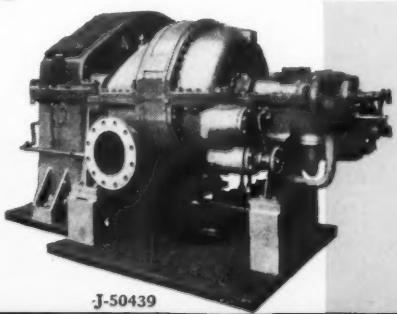
TYPE C—50 to 1500 hp, 1000-4500 rpm—Type C-225, "big brother" of Type C's, combines low first cost with higher efficiency. For steam conditions: through 600 lbs. ga., 750° F. inlet, 50 lbs. ga. exhaust.





HEAVY-DUTY SINGLE-STAGE—50 to 2000 hp, 1000-4500 rpm—Type CH turbines for high initial pressures and temperatures, and high back pressures. For steam conditions: through 1500 lbs. ga., 950° F. inlet, 300 lbs. ga. exhaust.





MULTI-STAGE—Up to 5000 hp, 1000—5500 rpm—Type M turbines for high-efficiency drive. Condensing, non-condensing and extraction types. For steam conditions: through 600 lbs. ga., 825° F. inlet, 200 lbs. ga. exhaust.

J-50439

STEAM HEADQUARTERS

WESTINGHOUSE

Boiler feed-line trouble?

BETTER USE BYERS WROUGHT IRON

Trouble with boiler feed-lines doesn't mean that the water is "bad"; as a matter of fact, absolutely "pure" water is about the toughest thing on metals that there is. But ordinary water contains oxygen, which corrodes the pipe. It contains carbon dioxide, which forms carbonic acid that eats the pipe. It normally contains a number of other substances which are death to ordinary piping materials.

Under certain conditions, there is much that can be done to make the water less corrosive. But even under the best conditions, the cheapest insurance is to use pipe of proven durability . . . and one of the best is wrought iron.

Why is Byers Wrought Iron pipe so successful in this service? It's because of the unique structure of the material. Wrought iron is a balanced combination of high purity iron and an inert, glass-like slag. The slag fibres act as a mechanical barrier against the progress of corrosion, and force it to spread, instead of pitting and penetrating. Then the slag anchors the film of scale on the surface of the metal, "armoring" it against further attack.

Just recently a large central station installed Byers Wrought Iron in boiler feed-lines to combat a difficult water condition. Another customer installed it to handle brackish water taken from a nearby lake. Railroads are large users, as they have had experience with all kinds of water conditions . . . and with wrought iron.

A. M. Byers Company does not believe in "blanket" recommendations for wrought iron. But if you will let us know what your water supply is—and will send us a sample, if we do not have the analysis among the 700 in our files—we will tell you what experience other engineers have had with wrought iron under similar conditions. You'll find some helpful and interesting information, also, in our technical bulletin, "Wrought Iron for Piping Systems." Would you like a copy?

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

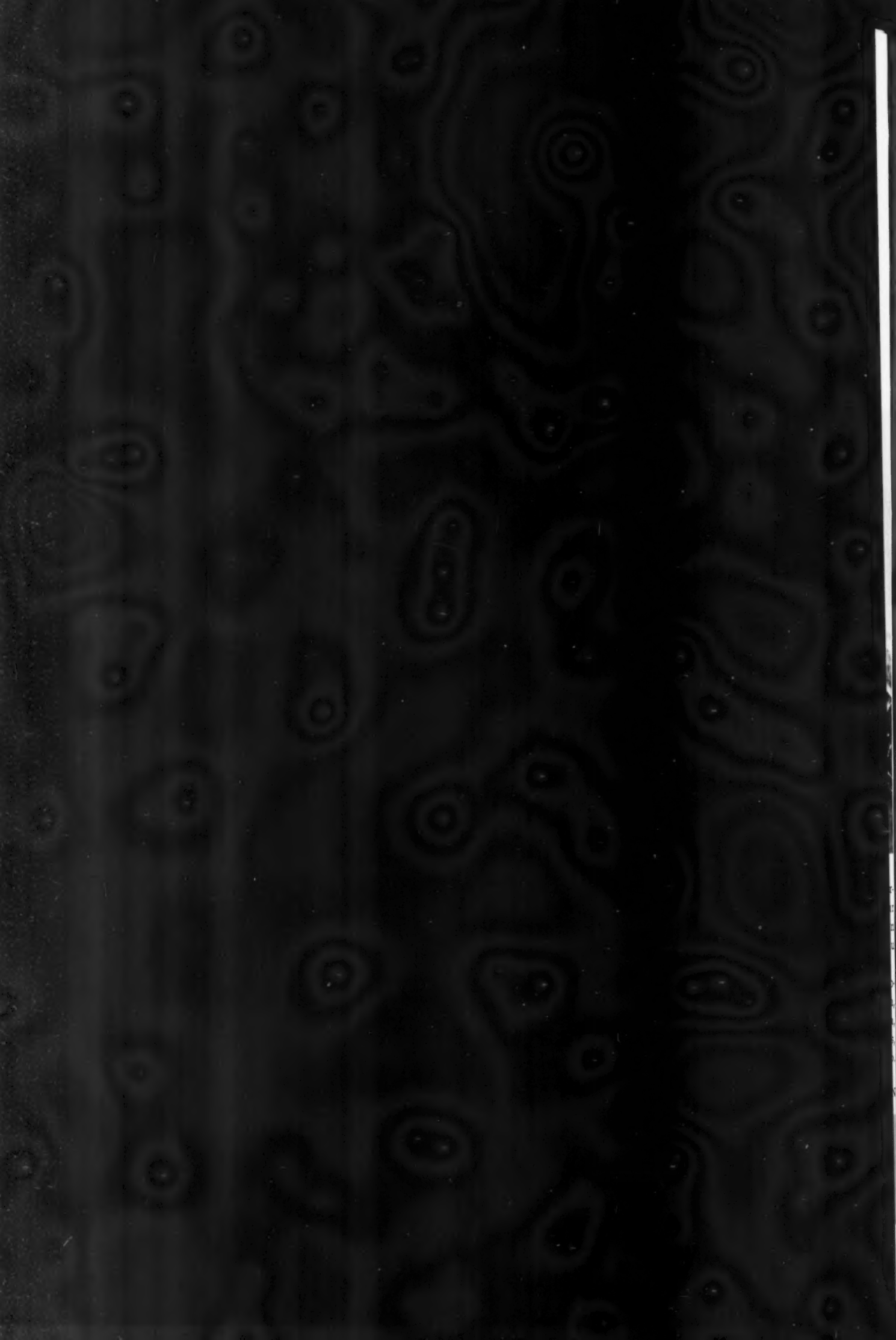
BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS OPEN HEARTH ALLOY STEELS

CARBON STEEL TUBULAR PRODUCTS



SEPTEMBER, 1943

P W SWAIN, Editor

POWER TO WIN

What generation, fuel and manpower will be needed for the coming months of war? A factual survey by the editors of POWER

LOOKING BACK, it's now 39 months to Dunkirk and 21 to Pearl Harbor – both bitter defeats of nations strong in the pursuits of peace, but woefully weak in the wiles and weapons of war. Not so today! Everywhere we are heavily armed for offense. In flaming anger the people have forged themselves weapons more potent and abundant than their own best hopes or the worst fears of the enemy.

Now we have won our initial victories on all fronts, and face the ultimate battles of Europe and Japan better equipped for warfare on land, air and sea than any other nation in history.

This incredible mass of munitions – these countless shells and bombs, these thousands of ships and hundreds of thousands of planes – are final proof that the long advertised drive and "know how" of America's industrial managers and workers were no idle boast. Never before anywhere in the world have so many war factories risen so fast and big in the empty meadows – plants so productive that the sum total of all available raw materials could not keep pace with their demands.

That's why war-plant building has stopped; we can't spare the men and materials, and we couldn't use the capacity. From now on we just make munitions – not things to make munitions with. Broadly speaking, we shall see no more new factories, no more synthetic-rubber plants or refineries, no more power plants, until the enemy has been cleaned out.

Looking backward from this milestone, the power industry can be proud that the war effort has never suffered for lack of electricity or steam. At one time or another, almost every basic requirement of the production front has run short – except power. The only thing about power that has suffered has been the style of it. Judged by prewar standards, it has been operated on shoestrings and maintained with baling wire – but don't forget that power men have always carried their assigned load 100%.

These emergency methods of operation and repair must last us through the War. The engineer must keep right on with his skimping and makeshifts, stretching existing capacity to keep the production wheels turning. This he can and will do, and with it he will find time to look ahead.

Looking at tomorrow has always been a major part of today's power job. Our engineers have carried their wartime power loads because they thought ahead in times of peace. The constructive thinking they do now will help them meet the emergencies of 1944.

This job of power thinking and planning is one the editors would like to tackle in partnership with the men on the industrial firing line, and to this end they offer this 16-page section, listing and interpreting vital power-field facts and trends. It considers the present and immediate future of central-power supply, industrial power plants, fuel supply and of the men who operate the nation's power plants.

At the very end, as a reminder to engineers, and as information for industrial executives everywhere, is a wall chart of the power-engineering staff's responsibilities and organization.

Power Balance Is

America now has world's greatest power plant, big enough to win the War if used to the full. But it will have to work at peak levels this winter, even with conservation of non-essential use in prospect. Pre-peace planning should start now, even though materials will be lacking for many months

Total electric power supply of the United States now exceeds 250 billion kwhr per year, according to a recent report of the Edison Electric Institute. This figure includes an estimated 50 billion kwhr generated and utilized in industrial and other individual plants, but does not, of course, take into account the output of some five or six million horsepower of mechanical-drive prime movers.

Few realize how gigantic our power-producing plant has become in comparison with the rest of the world. How, for example, does our power plant and its output compare with that of our enemies? What effect will this have on the course of the war? What will it mean in the "pre-peace" and "postwar" world?

The Axis powers have failed to keep us up to date as to the number and size of the plants they built for war production. Nor have they furnished statistics as to losses from bombing. However, by piecing together known information and adding some educated speculation, we come to the conclusion that Axis production must be uncomfortably short of kwhr while United Nations war effort is nowhere so handicapped. If the enemy had our power facilities and we had only theirs, we would *inevitably lose this war.*

Back in 1937, the League of Nations kept records of world power production. Output of the principal power-producing nations for that year are tabulated on this page. Geographical distribution of power equipment, as represented by kwhr produced, is shown on the facing-page map. The prewar picture can be evaluated most clearly by starting with the fact that the United States made about one-third of world kwhr in 1937.

UNITED NATIONS have increased their power output since 1937 by building new plants in the United States and Canada, and also by increasing hours use of generating equipment. Axis powers have boosted capacity by prewar installations in war factories and by conquest of territory. Figures at lower center of map show that United Nations now control lands that produced 60% of the 1937 kwhr while the Axis and conquered territory now hold equipment that produced only 35%. That this is truly a global war is indicated by the fact that neutral nations control only 5% of the total.

The Germans have about doubled their 1937 power plant by conquest. To their own 50 billion kwhr they have added France, Norway, Belgium, Czecho-Slovakia, Poland, Finland, Austria, Netherlands, Denmark, Rumania and Hungary (in order of their importance as power producers). Most power facilities in these countries were taken in relatively undamaged state. Power-made goods from Sweden and Switzerland also are exported to Germany; these countries generate about 15 billion kwhr annually.

Undoubtedly the Germans also added appreciably to their power capacity in prewar years by building facilities into new war factories. German practice has always favored generation of all power services within individual plants rather than transmission of bulk power from central stations.

On the other hand, western Europe has suffered heavily from air bombing. Power plants offer a choice target for the Royal Air Force, as evidenced by the destruction of the Moehne and Eder dams as well as blasting of power facilities in industrial areas such as Lubeck, Cologne, Duisburg and, more recently, Hamburg. We can estimate the amount of damage only by considering what would happen to our own ower situation if two of our major hydroelectric dams were breached and several 1000-plane raids hit Detroit, Pittsburgh, Los Angeles and other major industrial cities.

Italy, truly weak sister of the Axis in power capacity, generates only about 4% of a total of 15 billion kwhr per year by fuel plants. Since her hydroelectric potential capacity had been largely developed before the war and she is almost completely lacking in fuel resources, Italy can hardly be turning out much more power than in 1937.

1937 Electricity Production of the World's Principal Power-Generating Countries

BILLIONS OF KWHR PER YEAR

United States*	151.0	Czecho-Slovakia	4.0
Germany	49.0	Australia	3.9
U.S.S.R.	36.4	Spain	3.4
United Kingdom	28.7	Poland	3.4
Canada	27.7	Finland	2.8
Japan	26.7	Austria	2.7
France	18.1	China	2.6
Italy	14.9	Mexico	2.5
Norway	9.3	Netherlands	2.2
Sweden	7.9	New Zealand	1.3
Switzerland	6.8	Denmark	1.1
Union of So. Africa	6.0	Rumania	1.1
Belgium	5.5	Hungary	1.1

*Includes estimated 30 billion kwhr generated by individual industrial plants principally for their own use

With United Nations

Electricity has been rationed in Japan since before Pearl Harbor. Of 27 billion kwhr in 1937, about 80% was hydro. Because most of the available waterfall near industrial regions was already developed by that time, and because fuel resources are extremely limited, it is doubtful if Japan has appreciably greater generating capacity now than in 1937, except for the small amount captured in Manchuria, the China seacoast and the Netherlands Indies.

THE AXIS has little if any more power available now than in 1937 and poor chances of building any, if the foregoing reasoning is correct. Germany's plants are increasingly open to bombing; lack of power may well contribute to the speed of collapse of her industrial system. In Japan, power limitations certainly place a definite upper limit to long-term munitions-production rate, a condition that cannot help but shorten the war.

United Nations' four great power producing countries are, of course, the United States, the USSR, Britain and Canada. Of these, the United States produced more 1937 kwhr than all the rest combined.

Soviet power production has been deeply cut by loss of many industrial centers such as Kharkhov and Dnieprostroy. New factory sites far removed from the battle fronts still sadly lack power facilities although some equipment has been shipped from this country on lend-lease and more is in the making.

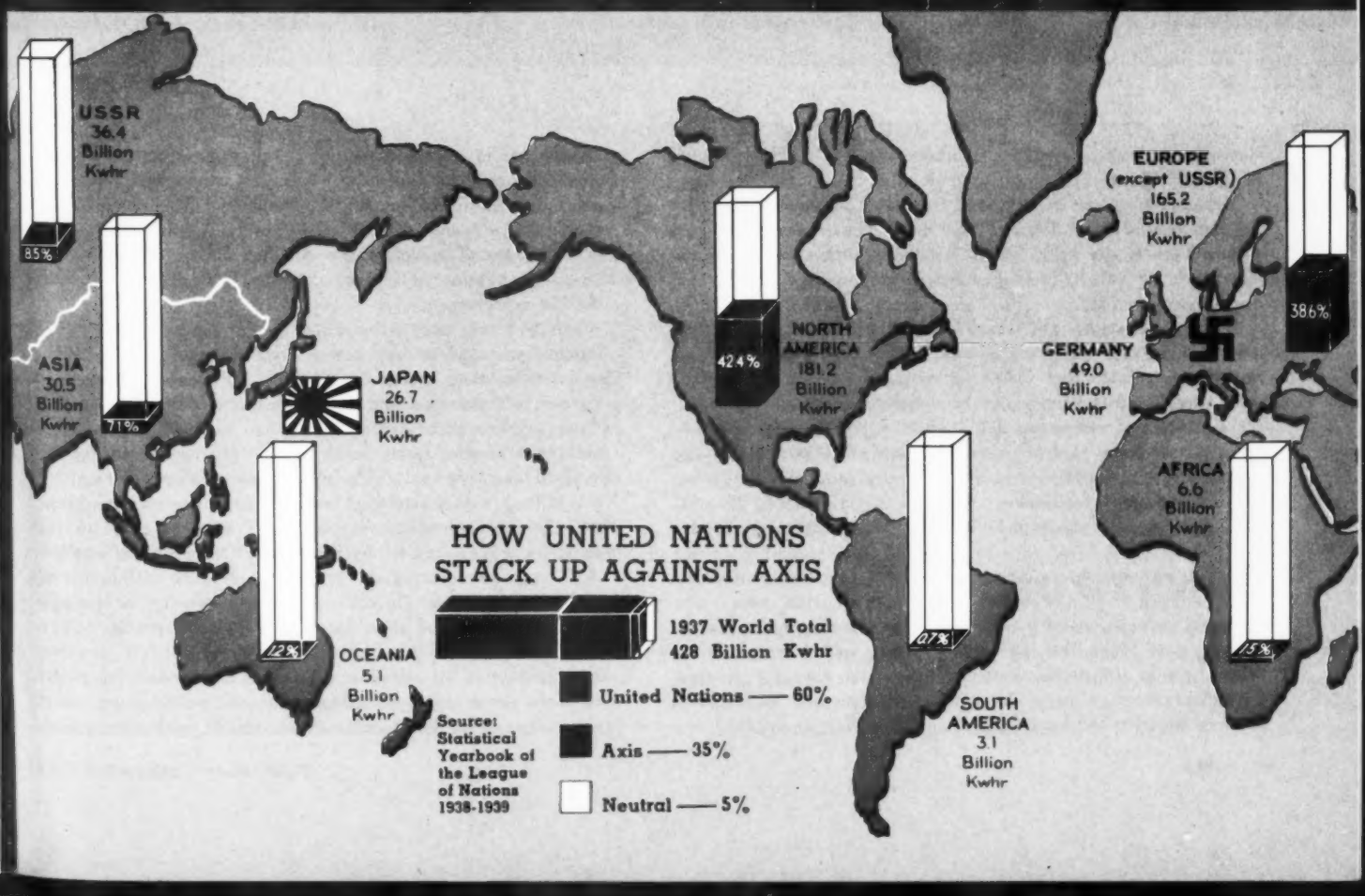
The Russians, however, have made sure that little, if any, of the power equipment they have abandoned is in condition to be of use to the Germans. Occasional photographs testify to Russian efficiency at demolition of dams and generators.

A number of reports from Britain indicate that rationing of electricity has been undertaken more from a fuel-saving standpoint than from lack of capacity. Emphasis has been placed on the "fuel target" rather than on reduction of peak demand. This can be taken to indicate that war industries have not been appreciably slowed by lack of electric power.

Our Canadian allies have not only stepped up their output from about 28 billion kwhr in 1937 to over 35 billion in 1942, but are still installing new generators at a relatively rapid rate. In 1942, new power installations totalled about 280,000 kw. Since the start of the war, they have installed approximately 1.2 million kw, more than 20% of their total prewar hydro development. In 1943, the new Shipshaw development will add another three-quarters of a million kw of which more than half is now in operation. Canada is now able to supply 90% of the British Empire's aluminum requirements as well as export some of the strategic metal to the United States.

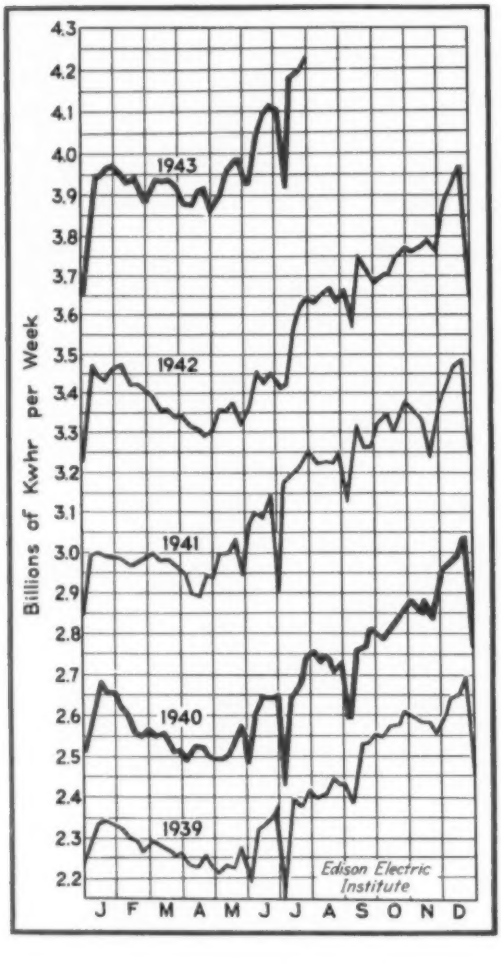
UNITED STATES part in the world power balance can best be expressed by the fact that the several-times-increased war-production schedule has never been limited or hampered by lack of electric power. Production of pig-aluminum, for example, now exceeds casting, extrusion and rolling facilities, mute evi-

WORLD DATA SHOWS UNITED NATIONS POWER



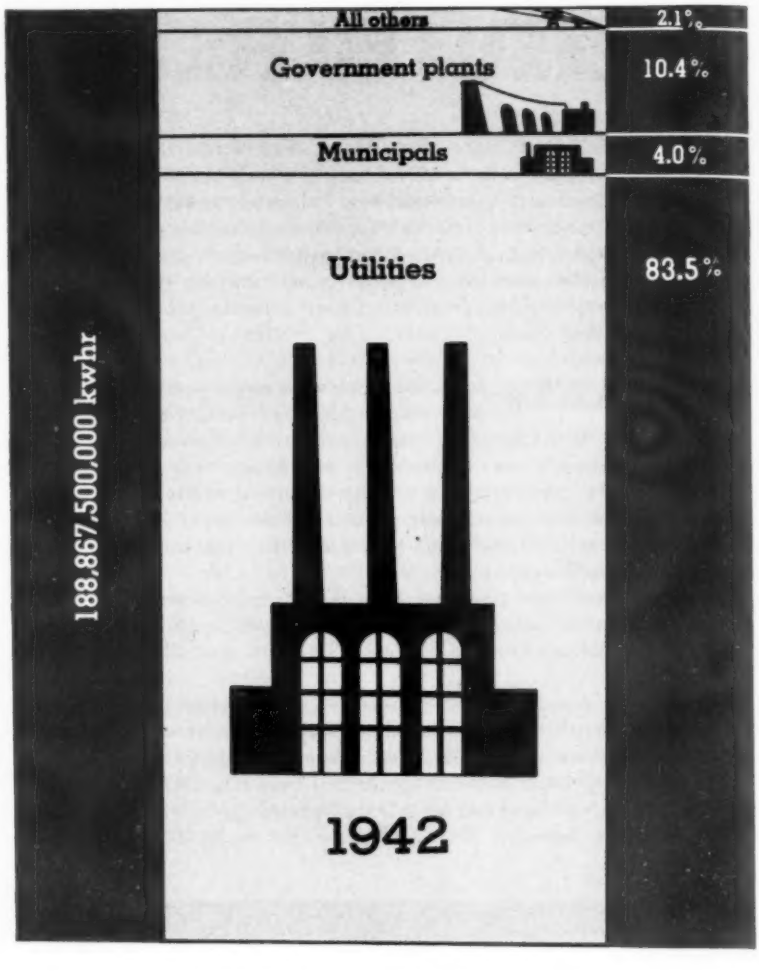
KWHR OUTPUT SOARS

Increased electricity output of public supply sources reflects growing production of goods



UTILITIES CARRY BULK OF LOAD

Even with greatly expanded government-owned program the lion's share of power for war plants comes from the systems of established utilities



dence that electric power is not and never was a bottleneck in airplane production.

Demand for kwhr has climbed from 150 billion in 1937 to a present rate of over 250 billion a year. The increase alone is comparable to the total kwhr directly available to Germany. The total output of the United States at present is more than double that for 1929.

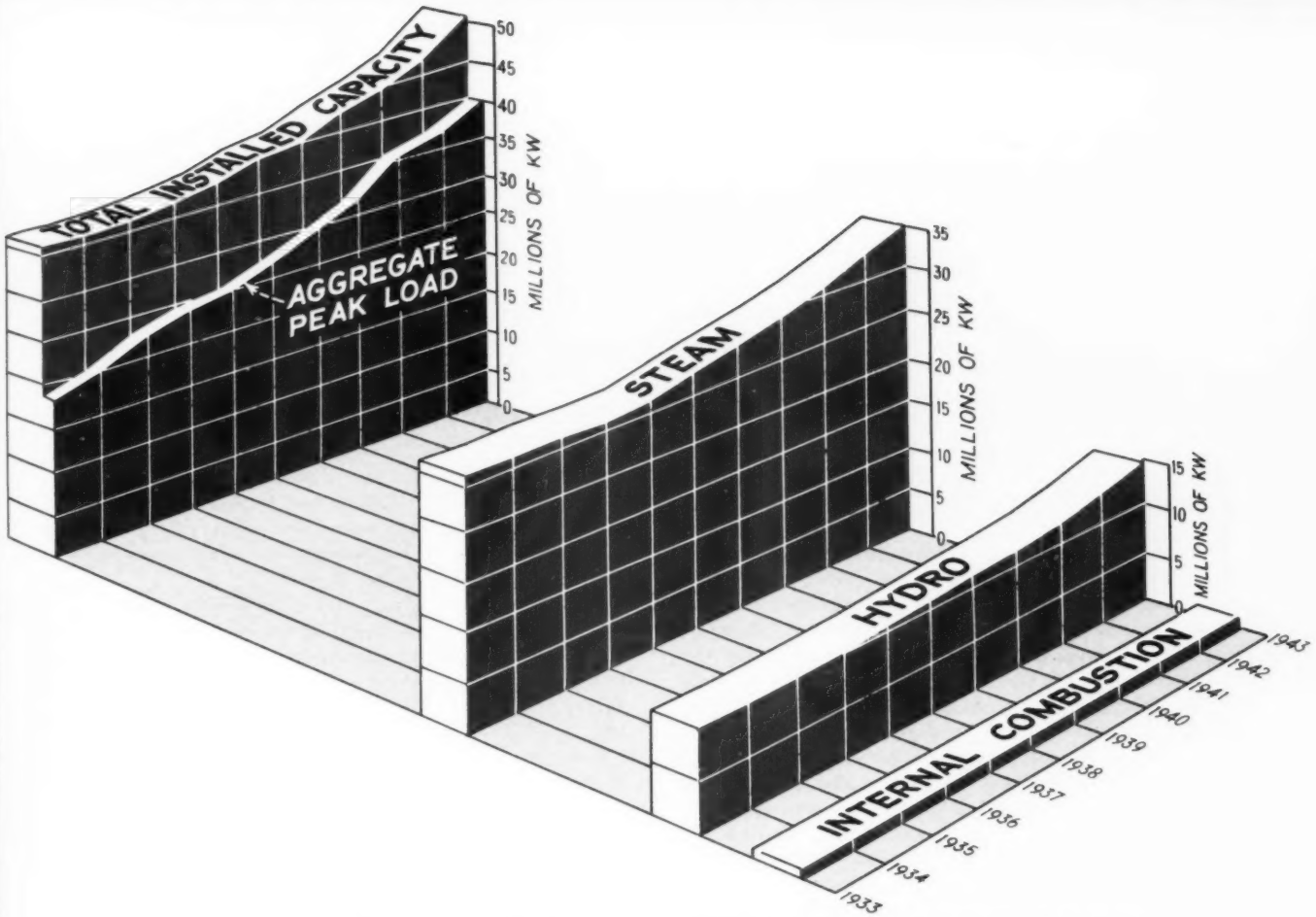
This output rate has not been achieved by wishful thinking or by normal peacetime methods. Careful planning of every phase of utility, government and industrial power expansion by experts who know their business has brought this country from the fanciful political estimates of July 1941 to a hard-headed minimum construction program that has released all possible material and turbine-building capacity for naval and maritime use, without, as present adequacy of power supply proves, leaving the war-production program lacking electrical energy.

CONSTRUCTION for the remainder of this year will bring the capacity of all plants contributing to the public supply to just over 50 million kw. These plants will have to carry somewhere in the neighborhood of 40 million kw of aggregate peak loads next winter. The margin of about 10 million kw between capacity and load has remained constant since 1940.

While this margin of "reserve" is not as great as many operators feel would be "adequate" in normal times to protect the "continuity of service" to which consumers have become accustomed, it has been sufficient so far to insure no shutdown of any war plant. Considering the dire predictions of the Federal Power Commission, this alone must be viewed as a very considerable achievement.

Pooling arrangements for coordinated operation of utility, municipal and government power systems have been in operation for more than a year. In Southern California, for example, a Power Interchange Committee arranges day-to-day swapping of both kw and kwhr among more than half a dozen separate systems. A similar pool, more loosely organized but equally effective, functions in the Pacific northwest. Power from New York City has been shuttled northward as far as Springfield, Mass. Pooling operations in these and other sections of the country have been credited by Director of Office of War Utilities J A Krug with assuring the equivalent of 1.25 million kw of additional firm power. In addition, swapping kwhr in one area has also been reported as saving 100,000 bbl of fuel oil during a 3-month period.

Interconnection of smaller municipal and industrial plants with large power systems, discussed last summer as an emergency measure, has not been found necessary. Such interconnec-



50-MILLION-KW PUBLIC SUPPLY TO CARRY LOAD

Construction phase of the war-production program is over as far as new factories and power plants are concerned. With a mere half-million kw more to come, present plants must handle all demands for the duration out of the margin of about 10 million kw between capacity and aggregate peak loads. WPB says it can be done with everybody's help

tion would have required appreciable amounts of copper and steel. Ability to carry all loads on existing systems has saved these materials for other more important uses. However, the necessary data has been compiled, the paper work has been done, and a local emergency could be dealt with quickly in event of failure of generating equipment or lack of water for hydro units.

PLANNING for the future must take into account: (1) that the construction phase, building new war factories, is over, (2) production of expendable goods of war such as planes, ships, ammunition and supplies, must be held at as high a level as possible and (3) that reconversion of war industries to civilian production will be a gradual process depending entirely on the availability of critical material and manpower. The first two of these can be faced squarely as facts. The third has already become the much-talked of but dimly outlined program of pre-peace and postwar planning.

Before 1944 becomes a reality, most of the synthetic-rubber plants, high-octane gasoline refineries and power plants will be completed and in operation. Extension of facilities for manufacturing all kinds of war goods will be restricted to the relatively minor changes necessary to meet revised needs of army and navy operations as determined by the actual course of fighting. For example, a shipyard that has been building cargo vessels might need pump-testing equipment if required to make tankers.

Results, in terms of power loads, of the huge construction program can be seen in the weekly kwhr curve at the top of the preceding page. Rate of use has increased more rapidly each year of the war as new manufacturing, electro-chemical and electro-metallurgical plants have come into active production. Many are just now getting into full swing. It is likely that margin of growth over last year will continue at least to the end of the year.

Present weekly consumption of electricity is running 15-20% above the record highs of last year. For the month of May large light and power consumers, principally industrial plants, purchased 57% of all power sold. Residential use accounted for only 17% of the total. Aggregate peak loads average about 4 million kw (12-13%) above corresponding periods of last year. All these add up to indicate that 1943 will be a critical year for power.

Not that next year's weekly outputs will merely equal the 1943 curve. All new facilities that come into production in 1943 will continue to call for power in 1944, probably in increased amounts as war plants push for greater production. The over-all increase, however, can be estimated with greater accuracy than in previous years because further construction of new power-using plants represents only a small item.

While increased loads have been provided for by installation of new capacity judged sufficient for the job, the fact of greater power use has burdened mines and railroads to the extent of at least half a million extra tons of coal per month at a time when both producers and transportation systems are struggling with other war needs. Conservation of electricity as a means of saving fuel and transportation has become a logical next step to help keep the war machine in gear.

Entirely on a voluntary basis, a conservation program has already been laid out by WPB's Office of War Utilities. Power companies, trade associations and others will begin soon to advertise in newspapers, magazines and radio to urge all consumers of electricity to eliminate or reduce unnecessary consumption. No effort is to be made to curtail street lighting, useful industrial or domestic illumination or any normally essential use of electricity.

BROWNOUT of lighting should in no way be confused with the "dimout" now required along ocean coastlines. The former is voluntary and will be initiated solely to save fuel; the latter, an Army order, is aimed at reducing sky glow that silhouettes ships at sea, making them vulnerable submarine targets. Of course neither should be confused with practice or real "blackout" for air-raid defense.

For the brownout, outdoor business establishments will be asked to eliminate any daytime lighting and reduce both wattage of lamps and hours of operation at night. Commercial customers will be urged to cut down lighting and other uses of electricity in any way possible. Domestic consumers will be offered suggestions as to ways and means to economize in the use of electricity for lighting and appliances.

Reduction of brilliant ornamental street lighting will be recommended. Operators of comfort air-conditioning equipment will be asked to set controls for more moderate margins of temperature and humidity. Industrial plants, factories, shops, institutions and hotels will be asked to bring their own individual and trade association ingenuity to bear on the conservation of power in any manner that does not reduce production.

Readers of POWER can be of specific help in putting across this campaign by: (1) organizing and publicizing a "power-saving" program within their own plant, and (2) using their specialized knowledge of the fuel and transportation problems to explain to less-informed people that a pound of coal not burned is a pound that does not have to be mined and carried to a power plant. Remember, a kwhr wasted or used for non-essential purposes represents at least one pound of coal lost.

It is suggested that every power engineer write a brief memorandum for circulation within his own plant wherever power or steam is used, saying in simple words that "power is fuel" and that "fuel savings will help shorten the war". Such a campaign must be persuasive, forceful and followed up frequently.

FORWARD looks at pre-peace prospects need not interfere with the essential jobs to be done in months to come: (1) to keep existing plants running at high loads and long hours under difficult conditions for the duration, and (2) to save fuel by every means possible. Intelligent planning starts with an understanding of the war-production problem and a comprehension of the step-by-step transition through the pre-peace period.

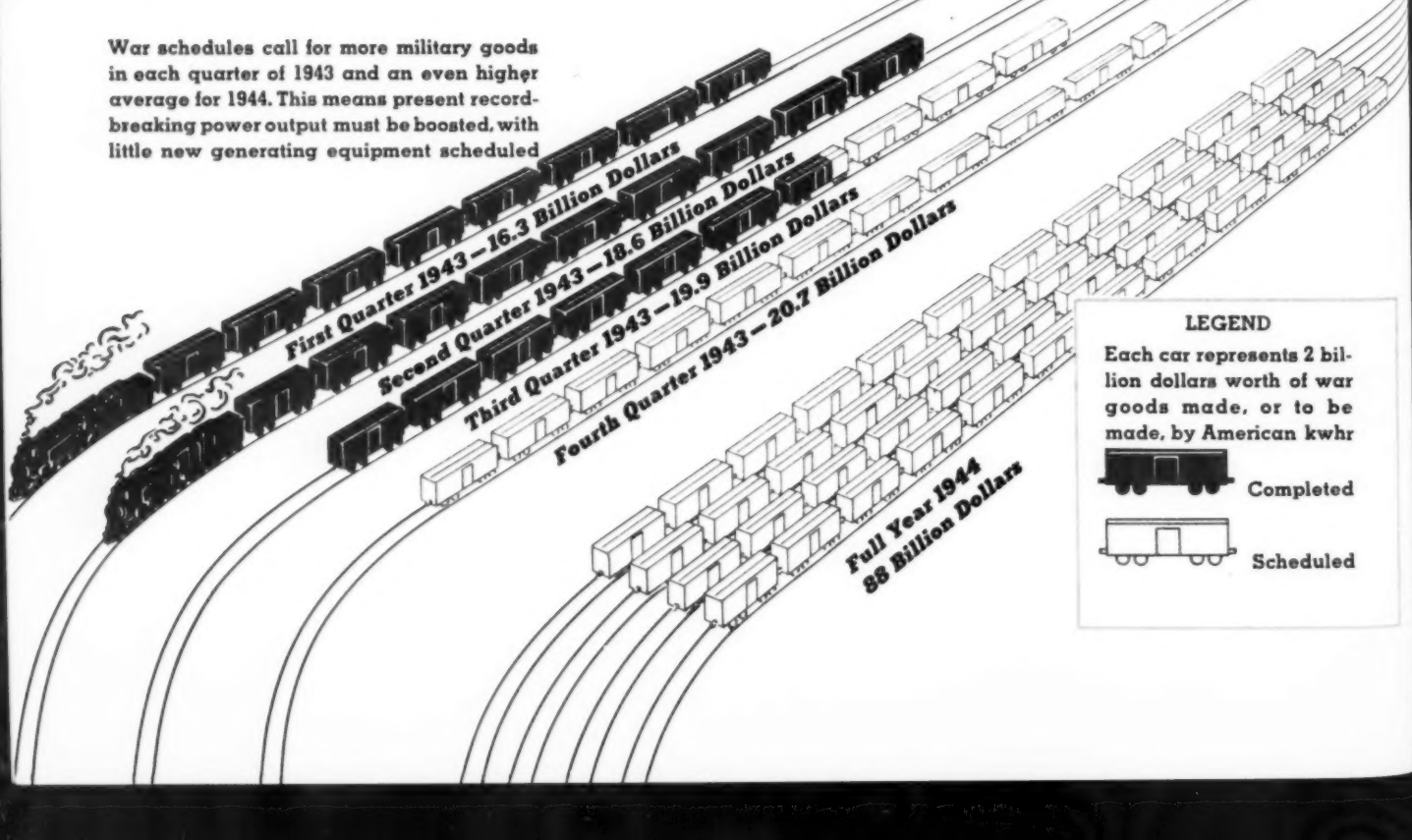
Will the war program slacken off soon because of military successes in the field? A recent statement by War Production Board chief Donald Nelson says "No". Schedules for the remainder of 1943 call for nearly 50% more actual production, measured in dollars, than was accomplished in the first half of the year (see chart below). Furthermore, each month of 1944 must see more goods roll off the assembly lines than the peak rate of 1943. We have the production facilities and the power plant to win over the Axis; indications are that it must be used to the fullest extent for many months to come.

Do "cutbacks" in tank, shell and certain other munitions orders forecast a general reduction in war orders? Those responsible for getting out what Army and Navy want state that cutbacks indicate only that the actual fighting calls for different and new items; production of certain others can be reduced because losses have been less than anticipated or the course of actual combat has not required the expected amount.

In Nelson's opinion, cutbacks will affect only one-third of the items of war material. For example, he says, plane losses in the

WAR GOODS WILL TAKE MORE KWHR IN 1944

War schedules call for more military goods in each quarter of 1943 and an even higher average for 1944. This means present record-breaking power output must be boosted, with little new generating equipment scheduled


First Quarter 1943—16.3 Billion Dollars
Second Quarter 1943—18.6 Billion Dollars
Third Quarter 1943—19.9 Billion Dollars
Fourth Quarter 1943—20.7 Billion Dollars
Full Year 1944
88 Billion Dollars
LEGEND
Each car represents 2 billion dollars worth of war goods made, or to be made, by American kwhr
Completed
Scheduled

Five Pre-Peace Pointers

WAR production will reach peak this winter and carry on at that rate for the duration; cutbacks in certain munitions will release small amounts of steel and other materials after first of year

CONSERVATION of electricity, as a fuel- and transportation-saving measure, begins soon officially; industrial and institutional power men can help by organizing voluntary campaigns in their own plants

MATERIALS for essential maintenance will be available; materials for limited modernization or expansion will have to be justified by real necessity for change

RECONVERSION of manufacturing plants to civilian production will be gradual; first steps will come late this year by encouragement of pilot orders

OIL faces continued restriction as a boiler fuel and indications are that it will cost more in relation to coal. Consider the advisability of making temporary oil-to-coal conversions permanent

Tunisian campaign were only half of what was anticipated. This calls, not for fewer planes, but for more gasoline and bombs. If other estimates have erred in the same direction, fighting will move faster and the "heat" must be put on production rates until the last Axis stronghold has collapsed.

All this spells an ever-changing war program revised often to suit the needs of actual fighting. Critical items to keep our own and other United Nations production plants running have not been neglected as opportunity has offered. For example, some locomotive builders who learned to make tanks are again turning out locomotives. Instances of this sort can be expected to multiply in coming months.

WHAT does this mean to the power industry? Specifically that materials, steel, copper and alloys are the controlling influence in how much of what is to be manufactured. Armed forces get first call. Essential maintenance of power equipment is high on the list. Where need has been shown, materials have been available for maintenance and there is no reason to expect this situation to change.

As relates to new power equipment, or modernization for efficiency alone, an indication of tightness can be had from the fact that only a half-million kw of new utility and government power units have been given necessary priorities for 1944-45. For many months to come, it would seem that little new equipment will be obtainable. However, need for replacement of less-efficient and over-burdened heavy power machinery grows greater with every passing month.

That there is hope of limited quantities of some materials becoming available during 1944 is indicated by present WPB studies to determine most-critical items needed for civilian consumer goods so that pilot orders for the manufacture of essential items can be released as soon as the materials situation eases.

Just as planning for consumer goods is receiving expert attention, similar forward thinking should be underway for power installations that are now operating close to the margin of safety. Changes in the military situation are unpredictable and the day when some items of power equipment may become available might be nearer than anticipated by authorities who must take a pessimistic viewpoint to assure winning the War.

Capable economists are even now predicting great expansion of utility plants for at least five years after the war. They visualize business conditions that would call for peak loads on public supply systems totalling 50 million kw. If this condition becomes a reality, postwar years will see the installation of some 20 million kw of new capacity at a rate equalling that maintained during the war years.

If these opinions are found to be correct, or even heading in the right direction, industrial plants will face a similar situation. A general period of prosperity, no matter how caused, would furnish the impetus for bringing many inefficient plants up to economical levels approaching that of best modern practice.

Even should the anticipated growth of general industry not materialize, or reach a level only part way up the scale, utilities will, of necessity, have to retire much old equipment that has been held in service only because new equipment could not be had in sufficient quantity. Industrial plants will need modernization programs to cut operating cost.

One factor in all future planning will be the cost of purchased electricity. Unlike practically all other commodities, electric power costs the consumer today just what he paid before the war. Despite increased taxation, fuel and labor costs, power companies have maintained existing rate structures. Most other materials and commodities, and certainly labor, will continue at existing high cost levels for the duration and for long after. Even if upward rate adjustments are made necessary in time by increased costs, there is every reason to believe that kwhr will continue to sell for relatively less money than the elements that make up power cost in isolated generating plants. If the latter are to keep pace, old plants must be modernized and new ones engineered to higher efficiency standards. Where industrial plants must install boiler equipment for process steam, higher fuel cost will also tend to justify refinements for efficiency.

POSTWAR industry is likely to require greater amounts of all power services to actuate a greater degree of production-line mechanization. To supply these services, designers will have available better and less costly equipment made with facilities already expanded and improved to meet war needs.

For example, manufacturers have learned much about production-line manufacture of marine turbines. Costs have been greatly reduced by duplication of manufacture, in comparison with building a similar number of land machines. While the same degree of duplication can never be obtained to suit the varied requirements of stationary plants, certain modifications in present methods of specifying turbine equipment can result in appreciable savings in cost of manufacture.

Without any "postwar" label, an ASME committee of utility men, consulting engineers and turbine manufacturers' representatives has already formulated tentative suggestions for standard turbines ranging from 10,000 to 60,000 kw.

While nothing in this program is intended to prevent new ideas or designs from being manufactured on a custom-built basis, the mere existence of preferred standards will reduce the tendency to depart from what most designers have found best suited to average conditions. The work of this committee is quoted here as just one example of the kind of down-to-earth planning that can be undertaken during the war by manufacturers and users together to improve efficiency or reduce costs.

Fuel

Production looms as major difficulty; transportation situation eases. Labor troubles cast doubt on ability to produce needed record coal output. Natural-gas restrictions remain. Oil demand outruns production; aviation-gasoline program may cut diesel-fuel supply; crude-oil reserves still decline

This winter, as last, will find power engineers exerting every effort to maintain needed high production levels with definitely limited supplies of fuel. Production now looms as a major limiting factor; cooperation and unremitting effort have eased the transportation situation, prime bottleneck of the past two years. Government will continue to play a prominent role in the fuel picture, controlling fuel-oil distribution and use, operating the coal mines, and standing ready to take whatever further steps may be required as the situation develops.

Armed with last winter's experience, power men face the fuel problems of the immediate future with assurance that they can be licked. The following pages indicate the nature of these immediate problems. But this is not quite enough. The long-pull fuel picture will influence many decisions that must be made in the near future, such as those involved in conversion of existing facilities and planning for new or modernized plants. Because authorities question future supplies of oil, there is also included a brief summary of the prospects for continued supplies of oil fuel in the years ahead.

COAL supplies last year just about met demands increased by all-out war production and conversions from fuel oil. Working at virtually top capacity throughout the year, bituminous mines produced 580 million tons against a forecast of 560 million, and anthracite mines turned out 60 million tons. By building the largest stockpile in history, coal users enabled the mines to hold the steady pace required to meet the vast demand, and helped spread the transportation burden.

This year, estimates put bituminous demand at 600 million tons, 20 million above 1942's all-time peak, and anthracite at 65 million. About 130 million tons of the total will go for space heating, an increase of 10 million partly resulting from conversions of oil-burning plants.

Biggest question mark is the labor situation. Stoppages in 1943 have already cost more than 20 million tons of output and cut the nation's stockpile by 8 million; in June it stood 3 million tons less than a year ago. Government operation has brought most of the miners back to work but doubt remains as to the future.

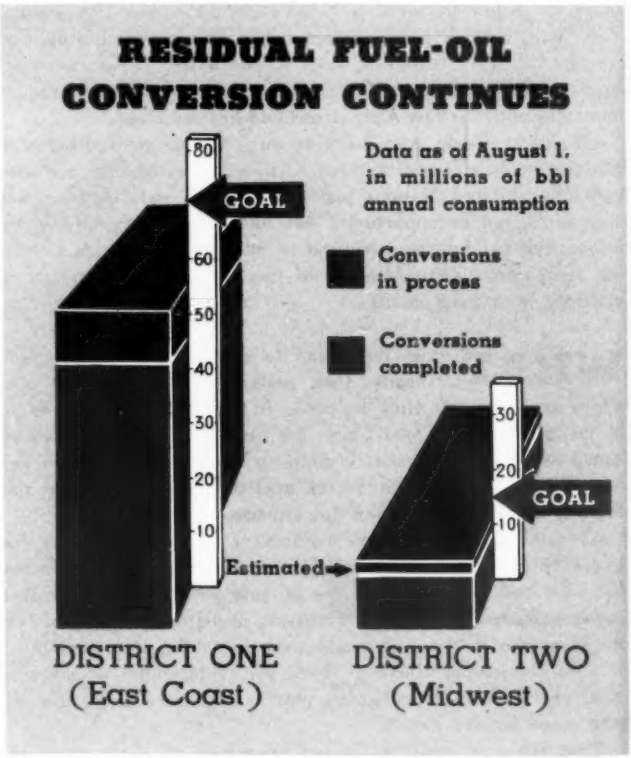
Labor unrest gets the headlines but it is only one of several factors clouding the coal-production picture. Even if all miners remain at work, the industry still faces a fast dwindling labor supply. Of the 451,000 workers in the mines on Pearl Harbor Day, the first year of war took 33,000 and since then the rate has accelerated, 30,000 more being lost in the first five months of this year to leave only 388,000 in May.

Action by War Manpower Commission and Selective Service to stem these losses failed to produce any noticeable change during the early part of 1943. Nor does recruiting hold out much hope; mining requires more skill and experience than can be gained from quick training. So far, the switch to a 6-day week has maintained production in spite of growing manpower shortages. But now weekly hours run close to the level that gives peak production per man; if losses continue the labor force will fall below that needed to meet the demand.

Coal producers also face a limitation on output in the form of shortages of new and replacement equipment. Unlike manpower, this situation promises to ease slightly as procedures for providing mines with essential equipment improve and as changes in the over-all production picture release critical materials, finished parts and equipment.

To sum up: Coal producers face in 1943 a bigger job than in 1942, and face it with fewer miners, no surplus equipment, a 20-million-ton handicap from 1943 strikes, and the prospect of further labor troubles. Failure to meet demand fully seems possible, but it is unlikely that shortages severe enough to require rationing will develop.

This year, as last, ability of the mines to produce coal and ability of the railroads to move it depend on cooperation of all users, large and small. This means: (1) contracting for coal requirements as soon as possible, (2) allowing fullest latitude as to size and kind of coal and as to shipping and delivery schedules,



Better, Supplies Short

(3) building stockpiles to recommended levels, and (4) keeping stockpiles at desired maximum as long as possible. For essential war industries, stockpiles should hold 90 to 120 days' supply; for other industrial users, from 60 to 90 days'. Continued cooperation in the stocking program begun so successfully last year will insure the even week-by-week mining and movement of coal that is absolutely necessary if the production goal is to be reached.

GAS production in 1942, including amounts for manufacture of carbon black and for field use, exceeded 3000 billion cu ft; about 232 billion cu ft of natural gas were used as fuel for electric power generation, an increase of more than 12% over the preceding year. About 75% of natural-gas production goes to industrial use, most of it essential to war production.

This growing use of gas in essential production made it necessary for WPB to issue orders limiting certain uses, notably new installations for space heating. By a form of voluntary rationing, space-heating consumption was reduced and provisions were made for steps to be taken when serious shortages threaten. Need for limitation orders on natural gas arose from the difficulty in securing steel and other critical materials for expansion of pipeline and storage facilities. Similar steps were taken in the manufactured-gas field, where reduction in fuel-oil supplies threatened shortages in some areas.

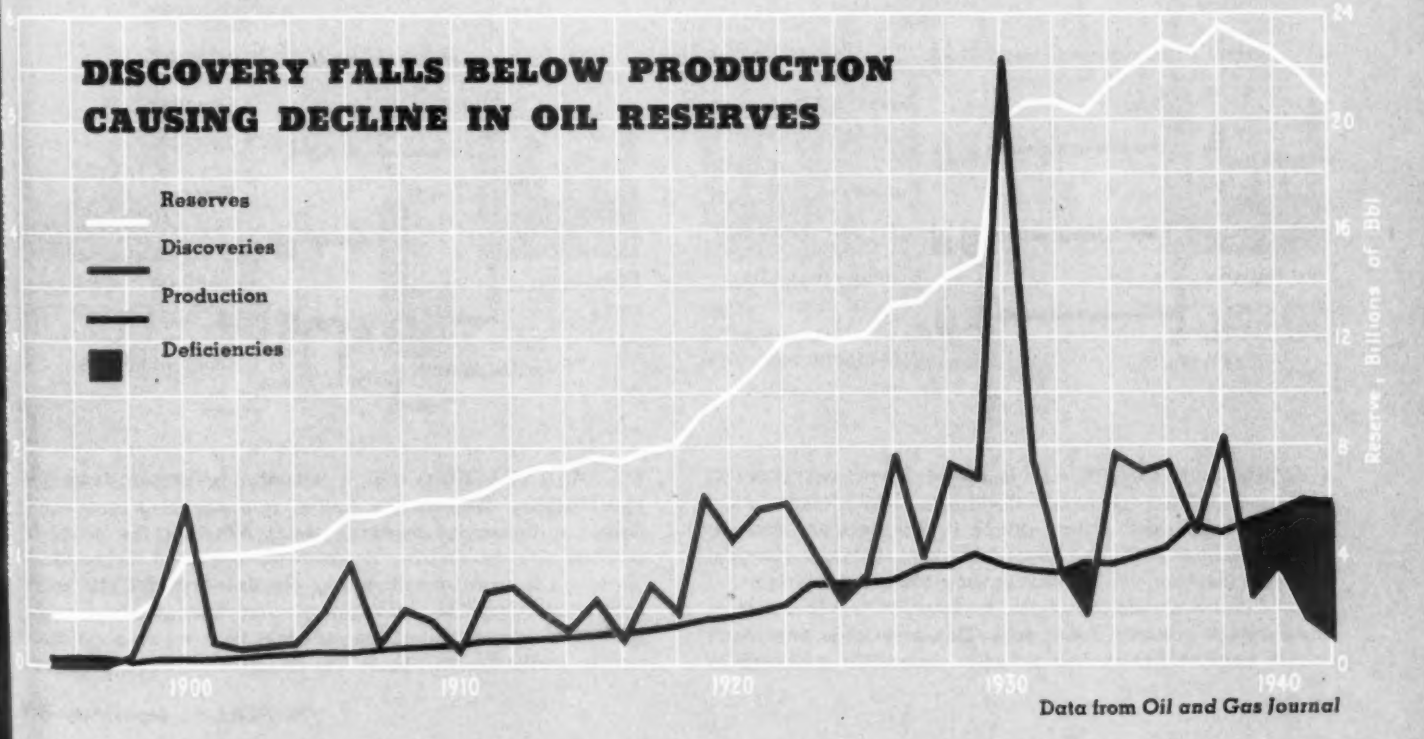
Several steps taken in the past year will put the industry in a better position to meet future requirements, notably relaxing restrictions to permit new well drilling in the Appalachian area, parts of Oklahoma and Missouri, and eastern Kansas. New production should help materially to relieve shortages that have developed in these areas. To increase storage capacity in the Los Angeles region, and thus make capacity available during peak periods, the Playa del Rey oil field will be used as a reservoir. It will hold about 2 billion cu ft of natural gas.

Present forecasts indicate increased demand for natural gas throughout 1943 and into 1944. Rising levels of war production (see chart on page 68) will account for much of the increase, directly in the form of fuel and raw materials for industrial processing and indirectly as fuel for electric power generation. As the result of increased study, use of gas hydrocarbons as raw materials for manufacture of 100-octane gasoline, synthetic rubber and other war chemical products is expected to put additional demands on production.

There is thus every indication that demand will continue to outrun supply and that existing restrictions in critical areas will remain in force, and may be tightened.

OIL continues to hold the spotlight after a winter in which basic needs were barely met with every possible means of transportation strained to the utmost and with 32 states under fuel-oil rationing. This winter we face a new situation: For the first time since before Pearl Harbor, we can move oil as fast or faster than we can produce it.

Consuming about 40% of the nation's petroleum output but accounting for only 2% of the crude production, East Coast industrial states traditionally depended on tanker shipments from the Gulf states and South America. The history of the past two years on the oil front has been a fight to develop substitute transportation – railroad, pipeline, waterway and highway – for the war-lost tanker routes. The figures tell how this battle has been won – in June 1941, about 75,000 bbl per day



Data from Oil and Gas Journal

moved East by substitute routes while 1,400,000 bbl now roll daily, enough to meet expected civilian and military demand.

To the railroads, the oil industry, PAW and ODT goes the credit for doing a job believed impossible. From virtually nothing, movement by tank car from the oil fields of the Southwest to the oil-consuming centers of the Northeast has grown to the astonishing level of a million bbl a day. Close to 74,000 tank cars ride the rails in this east-west traffic; plus those in intradistrict service, they represent about 75% of the 107,000 tank cars in petroleum service in all parts of the country. Need to maintain supplies to war plants and to meet offshore military demands, as well as a desire to spread the oil-shortage burden equitably, led to diversion of most of the cars from Midwest and Southwest service.

Biggest reason for success of the tank car program lies in operation on a train-load-lot basis; about 90-95% of the tank car movement rolls East in solid trains, which move on fast through routes and schedules fixed by PAW and ODT. Other speed-up factors include: (1) reduction in idle car time, (2) elimination, as far as possible, of cross hauls and back hauls and (3) diversion of short-haul traffic (200 miles from point of origin) from tank cars to trucks, which has released 25,000 tank cars for East Coast service.

Conversion of dry-cargo barges to tank barges and building of wooden tank barges and towboats will relieve the railroads of part of the burden. Main water routes include: (1) Great Lakes to Buffalo, (2) Mississippi-Ohio Rivers to the Pittsburgh area, and (3) Gulf Intracoastal Canal from Texas to Florida, across Florida by pipeline, and from Jacksonville as far north as Wilmington, N. C., by the Atlantic Intracoastal Canal. Full use of these routes will shorten the rail haul east for many thousands of barrels.

Also under way is an accelerated program for building tank trucks. Highway transport fills in on the short hauls and connecting links, permitting the railroads, pipelines and waterways to operate at full efficiency on the long-haul job.

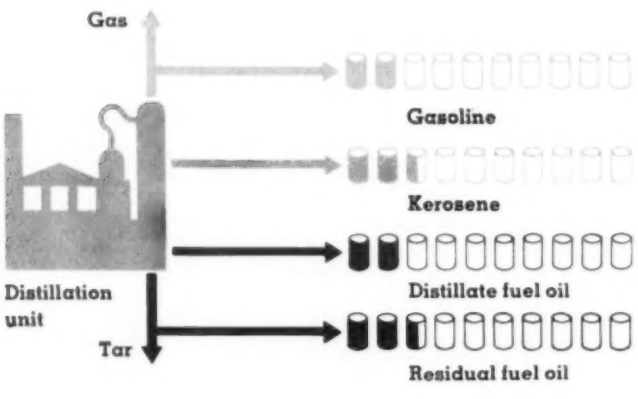
BIG INCH world's largest pipeline, with a rated capacity of 300,000 bbl per day, was completed to Norris City, Ill., by February, 1943. The second section, now in service, brings crude directly to the refineries of the Philadelphia-New York-New Jersey area. Under recent authorization, work speeds ahead on a 20-in. line paralleling Big Inch, designed to handle 235,000 bbl per day of refined products. If materials reach the job on schedule it will finish by the end of the year, with full operation by April, 1944. This will mark completion of the present pipeline program; total capacity serving the East Coast will have grown from 42,000 bbl per day before the emergency to 740,000 bbl per day.

Gains in the battle of transportation form no basis for optimism, however. Effect of pipelines has been anticipated in all calculations, and first call on oil arriving in East Coast ports goes to the armed forces. Furthermore, the shoe is likely to pinch on the production foot from now on.

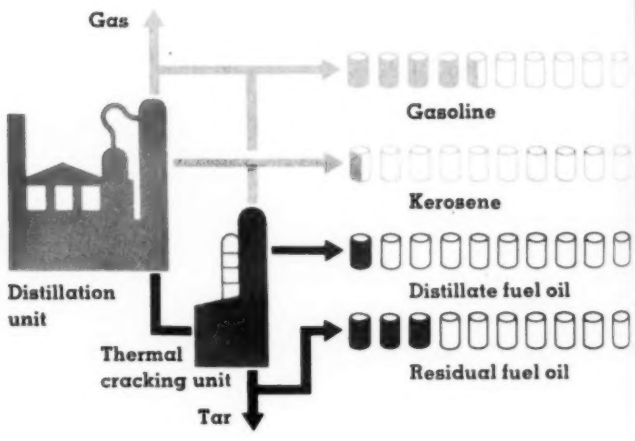
Petroleum demand broke records in 1942 and so far outran supply that total oil stocks at the start of 1943 stood at the lowest point in 20 years. Estimates for the last quarter of 1943 and the first of 1944 vary from 4 to 4.3 million bbl per day. This assumes domestic and industrial consumption of petroleum products at rationed levels established last winter and continuance of the conversion program (see chart on preceding page). Military requirements represent the big unknown in all estimates. Should offshore military demand run larger than the margin allowed, civilian supplies will suffer accordingly because

ADVANCES IN REFINING CHANGE FUEL-OIL PICTURE

To make the desired product, gasoline, the refiner formerly had to make certain amounts of residual products which had to be disposed of, as fuel, for what they would bring. By modern methods he can convert most of these other products into gasoline, although at higher cost. Thus amount of each product made depends



TOPPING or SKIMMING — Until World War 1 virtually all crude was refined by simple distillation, which takes out of the crude only what nature put in it. Amounts of "straight-run" products thus formed depend largely on nature of crude. Gasoline yield is low. The distillates make good heating and diesel fuels; the residual oil can be handled in some diesels and forms a common boiler fuel. This method is now used only in small refineries; heavy fuel is essentially a byproduct



THERMAL CRACKING — High temperature breaks down the hydrocarbons forming the heavy fractions of a crude oil; lighter and heavier fractions result. Whether the crude is cracked directly, or after it has been topped of its gasoline, the result is more gasoline, less distillate-type oil and more heavy oil. Gasoline produced by cracking usually ranks higher in octane rating than straight run; cracked residual fuel is markedly inferior to the residual oil from "topping"

the figures given represent the maximum supply.

With outlook for civilian supplies next winter about the same as last, or only slightly better, restrictions will remain in force. Plant conversions will continue, as directed by the PAW; Office of War Utilities will direct conversions or interconnections of plants using oil for power generation. Where conversion proves impossible, PAW or OWU will certify the plant to OPA for rationed fuel-oil supplies. However, receipt of a ration allowance carries no guarantee that oil supply will be maintained. Engineers of plants that cannot convert must plan to operate on reduced supplies and must be prepared for local supply failures.

Use of colloidal fuel may offer a means of stretching rationed oil allotments. Recent tests (see POWER, June 1943, pg 74 and August, pg 72) show that mixtures of oil and finely pulverized coal can be burned successfully under favorable conditions. Thus far no steps have been taken to construct plants for production and distribution of colloidal fuel and it seems unlikely that any will be available for the coming winter. However, at least one industrial plant plans operation of its own equipment. For on-the-spot use, mixing can be simple and commercial grinding mills will handle the job so there seems no reason why power engineers should not consider the possibility, if needed equipment can be obtained.

FUTURE prospects for fuel oil depend both on the refinery situation and the supply of crude. Immediate danger lies in the effect of the 100-octane gasoline program. Conversion of refinery facilities to 100-octane production cuts into output of kerosene and distillates, particularly diesel and light heating oils. At least one authority estimates that suitable diesel fuels may be on the critical list by 1944.

Aside from the special considerations of the war-stimulated aviation-gasoline program, it should be noted that the whole trend of refining advances is toward high yields of gasoline and smaller yields of distillates and residual oils (see chart below). These changes in refining technique take fuel oils out of the byproduct class because the refiner now has almost full control over the output of various petroleum products and can adjust production of each to yield maximum economical returns. The conclusion is obvious: In such a situation, increased prices for distillates and heavy oils will be necessary to insure supplies adequate to meet the demand.

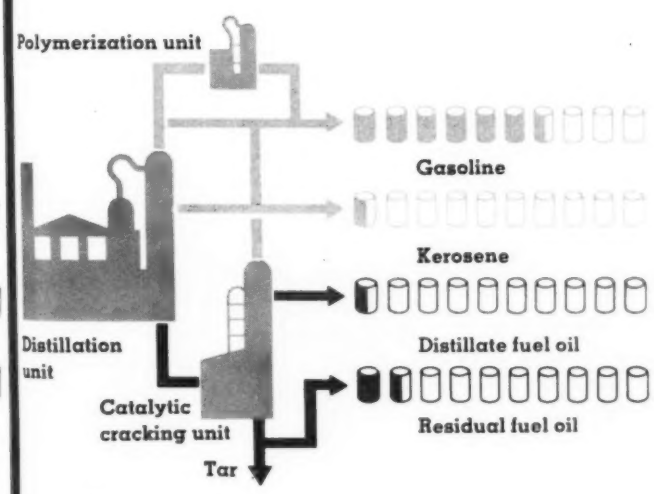
RESERVES of crude oil present another large question mark. Competent authorities point to the fact that, since 1939, production has exceeded discovery and that reserves have declined at a serious rate. If this low rate of discovery continues for the next three years, and production is forced to meet current demands, damage to many fields will further reduce reserves.

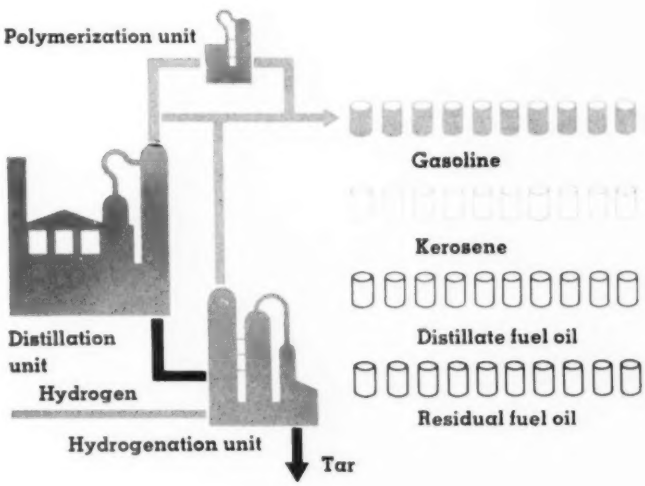
Other geologists claim that the answer lies in intensified exploration and that present low rate of discovery grows out of wartime manpower and materials shortages, which have hampered exploration, and lack of incentive in the form of adequate crude prices. They hold out the hope that full use of modern geophysical methods will discover the vast new fields needed.

If a petroleum shortage develops, increased imports represent the first line of defense. As crude prices rise because of short supplies, production of oil from shales and from coal by hydrogenation, technically feasible but now economically unsound, will come into play. Even if worst fears are realized, we do not face an oil-less future but rather one in which high cost will confine use of oil as fuel to fields, such as transportation, in which it enjoys other than economic advantages.

largely on demand and price. The highly simplified diagrams below show the major steps in refining progress and the effect of each on the yield of gasoline and other products. Processes and yields differ widely from refinery to refinery; thus the diagrams and percent-yield figures are not actual but purely illustrative

Each filled barrel represents 10% of amount of crude charged





CATALYTIC CRACKING — Cracking in the presence of a catalyst gives greater yields of higher anti-knock gasoline, less of heavy residue. Heavy fractions can be re-cracked to lighter.

POLYMERIZATION combines the light hydrocarbons into heavier ones, making it possible to convert into gasoline the "fixed gases" formerly used mainly for refinery fuel. Modern refineries operate for maximum yield of profitable products

HYDROGENATION — Previously outlined processes rearrange the original hydrocarbons of the crude but add none. If, however, free hydrogen is added to heavy hydrocarbons at high temperature all the heavy fractions can be transformed into lighter fractions. This is essentially the same means used to make oil from coal. Today, hydrogenation proves uneconomical; if crude prices rise it may come into use as a means of producing maximum gasoline from limited crude supply

Power Engineer's Future

This is not a "post-war planning" section. Its primary concern is with the problems immediately ahead – from now to war's end, or what might be called the "pre-peace" job.

From this point of view, the manpower situation promises to be "more of the same", with some minor changes. More young men will be inducted into the armed forces and the long arm of Selective Service may reach into classes yet untouched, notably the fathers. On the other hand, recent "freezing" orders will offer some protection against loss of trained men to other war industries. Striking a balance, we may say that power plants will continue to lose men, but at a somewhat slower rate.

This means that power engineers still face the job of filling gaps in the plant "firing line", by training new men, and women, by upgrading others, and by bringing back into harness such older men as may be available. By and large, individual engineers seem to have licked the training job, either by informal on-the-job schooling or by organized training classes. Several companies have found that women can swing power jobs once thought the exclusive province of men. Manpower shortages have also been licked by putting green men to work with old-timers, to stretch the available "know how". The green man does the heavy work and learns while doing it, the skilled old-timer gains an extra pair of hands and is on deck for emergencies.

OPTIMISM must be tempered with caution, however. From the purely numerical standpoint, the manpower situation should get no worse and may improve slightly, but the going promises to get tougher in another way. Today's power plants are turning out record-breaking quantities of kilowatthours. They must continue to do so, and even raise the ante, until the War is won. This will require the utmost in skilled operation and careful maintenance. To swing the evergrowing war load with overloaded equipment and under-par staffs will test to the full the power engineer's technical ingenuity and powers of leadership.

So much for the immediate manpower situation. A longer look into the future seems in order as we turn to the personal career of the power engineer, which is the main subject of this article. Young engineers, particularly, must plan for the long pull. So let's consider what the next decade has to offer today's power engineers and those who may enter the field after the war.

Any logical attempt to answer this question must consider (1) the probable post-war level of American prosperity and industrial activity, (2) the trend of the relationship of the power services to industry, (3) the trend of management's appreciation of the power engineer as a vital factor in product cost and quality, and (4) the growth of the average engineer in technical competence and the ability to sell himself.

First, is prosperity ahead in the long run? Nobody can prove it one way or another, yet careful studies by an old-line government bureau (Department of Commerce) and by independent business men (Committee for Economic Development) give good reason to expect a major long-term industrial boom after the War, allowing for a short period of readjustment. After 1945, true national income, measured in 1940 dollars, may average 50% above the 1940 level for eight or ten years, according to these studies.

IF AMERICA actually achieves this expected long-term high level of industrial and business activity, it must inevitably involve industrial "wheel turning" on a scale equally vast. And that spells heavy energy demands on both central stations and industrial power plants. The prospect is particularly bright because power generation would profit not only from the generally high level of industrial activity, but also from increasing recognition of the power services as effective tools of production and as an important factor in "good living".

Of this last we see many signs. Peace will revitalize the prewar boom in air conditioning for both comfort and product quality. Food preservation, with war-stimulated advances in quick-freezing and dehydration, will take far more refrigeration and steam than before the War. New developments in welding, and direct, infra-red and high-frequency heating, as well as increasing electrification of all industrial operations, will boost kilowatthour production. The growing plastics industry, the processing of the many war-born chemical products, and the manufacture of synthetics all will take more steam and hot water. In addition, central power plants will profit from the increased domestic consumption that will follow the expected rise in the national income and standard of living.

Will management increasingly recognize the power engineer as a major department head with important influence on company operations? We think yes. Even before the War, many progressive companies were paying good salaries to real power engineers, giving them ample assistance and authority and getting a high return in the shape of dependable service and low unit costs.

Under a competitive system, notably successful industrial practices spread partly by contagion and partly by the shrinkage and demise of less progressive firms. Hence the future should see increasing recognition, pay and authority for the power engineer who can deliver the goods.

This trend is a danger signal for the incompetent and for those, once competent, who have not kept pace with the progress of the power services in industry. As more becomes expected of engineers any individual failings will become more evident.

TRADITIONALLY the field of power plant operation has been that of self-made men, educated mainly on the job. College men have been in the minority and some of these have been criticized as lacking in basic practical experience. Many of the practical men, on the other hand, have found lack of skill in theory and computations a handicap hard to overcome.

One of the most encouraging signs of recent years has been the growing recognition of individual weaknesses on all sides, with an increased interest in home study among self-made men and in early practical experience among the school trained.

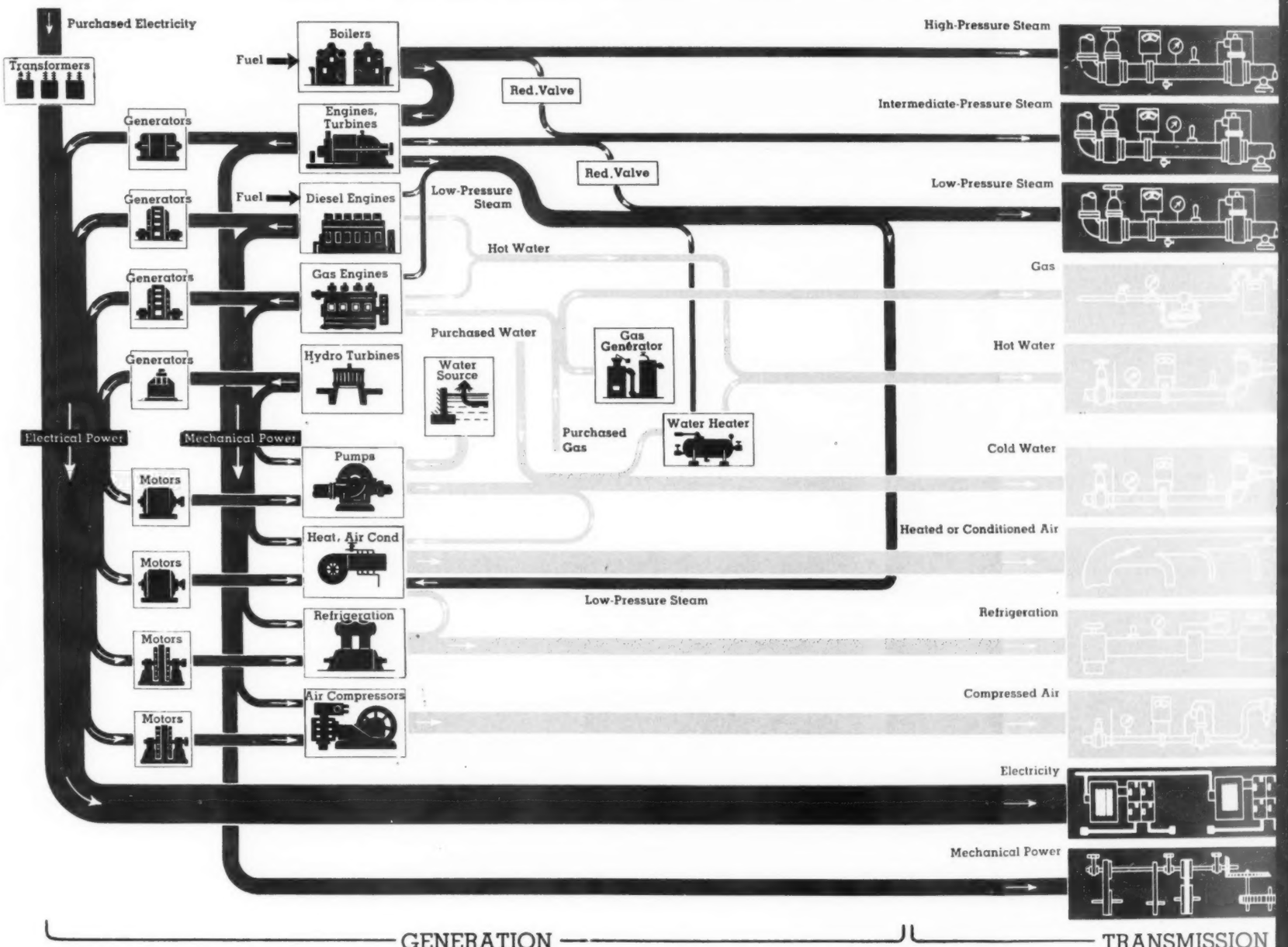
Careers of today's leading power engineers demonstrate conclusively the need for combining theory and practice. These men got plenty of rough-and-ready plant experience early in the game and never stopped studying the technical side of the job. They take an active interest in the technical societies and they keep up with the engineering developments of the day.

These are essential steps to all-around power competence. In addition, the ambitious power man must drill himself in qualities of leadership – in ability to handle men, diplomacy, good presence, ability to speak and write clearly and acceptably, and salesmanship. It seems reasonably certain that a man with these technical and personal qualifications will find after this war a world glad, for value received, to insure him a good living in the field of power-plant operation.

Responsibilitie

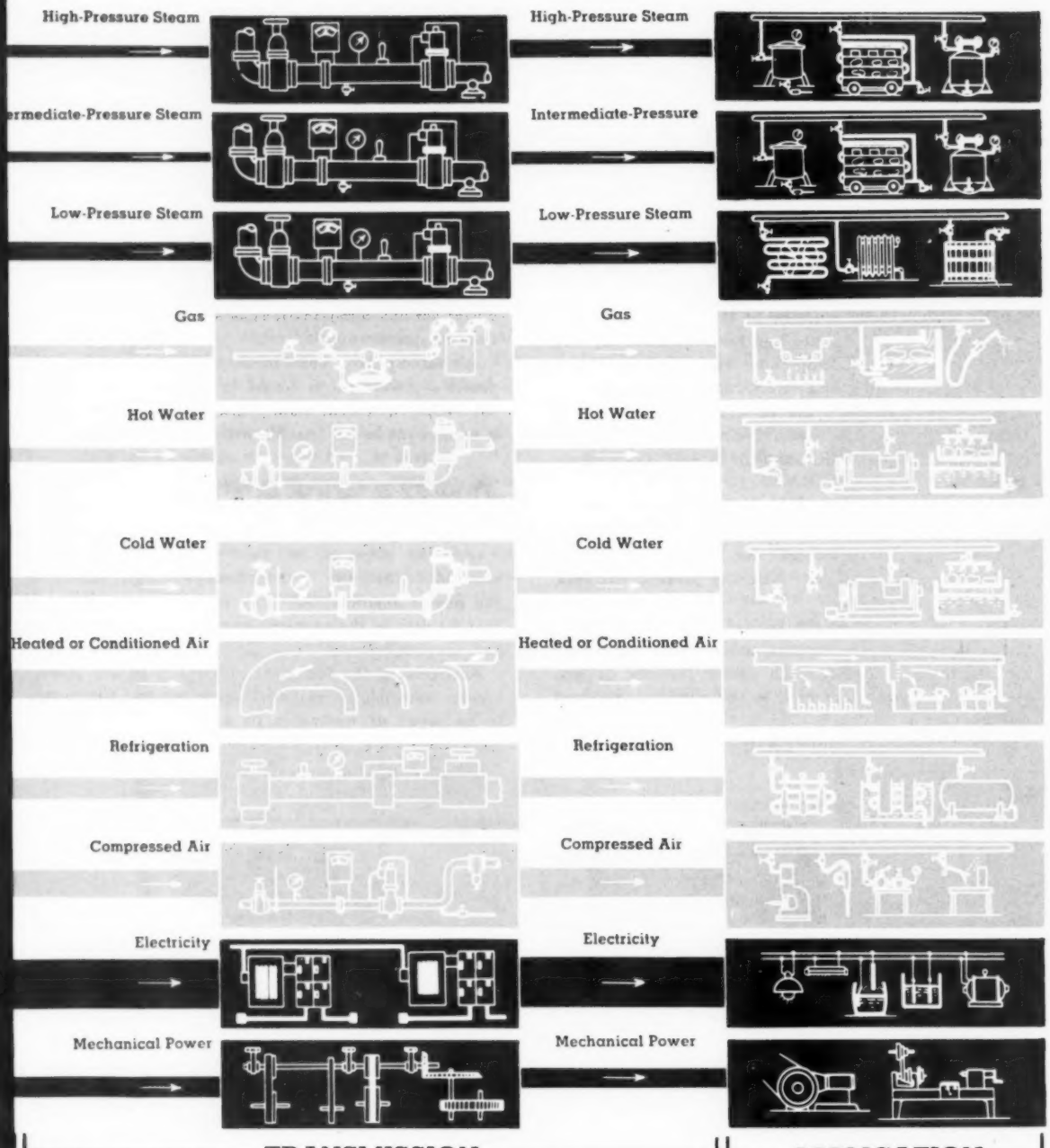
POWER-ENGINEE

This chart pictures the generation, transmission and application of all the power services commonly used in industrial plants, institutions and buildings. The *generation* of these services, as diagrammed at the left, forms the basic job of the power engineer and his staff. This responsibility usually extends to include *transmission* of the services throughout the entire the final on these



bilities OF THE
R-ENGINEERING STAFF

e left, forms the basic job of ff. This responsibility usually n of the services throughout the entire establishment, center of chart, and may include the final *application*, right. Note: For detailed comments on these responsibilities see discussion on back of this sheet



THE Power Service ORGANIZATION

THE CHART on the reverse side shows the *generation*, left, *transmission*, center, and *application*, right, of all the power services. *Generation* of these services is always the responsibility of the power-engineering staff. In industrial and institutional plants this responsibility usually includes *transmission* of the services, as well.

Thus the power engineer and his staff must lay out, install, operate, maintain and repair the complex arterial systems of piping, ducts, cables and mechanical transmission that carry his services to the industrial consumers in the production departments — or to the service-consuming departments of buildings and institutions.

When it comes to *application* of the power services, practice varies from industry to industry and from plant to plant. Responsibility for application may lie with the power engineer, with the process engineer, or with both jointly.

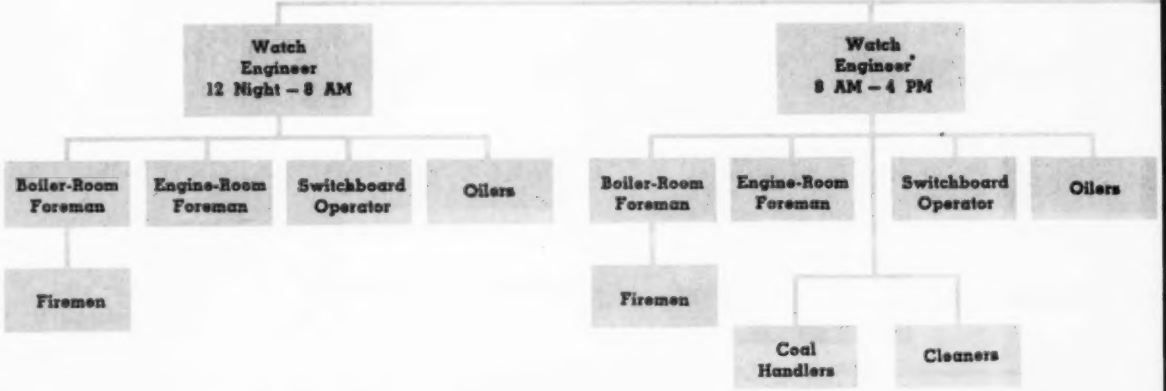
Under *generation*, at the top left of the chart, note the boilers and prime movers and, at the bottom left, the subplants producing such power services as gas, hot and cold water, heated or conditioned air, and refrigeration.

Note how each of these plants or units may supply service to another as well as to factory consuming departments. Thus, for example, the boiler may supply process steam, also steam to run an engine. The mechanical power generated by the engine may drive an electrical generator, and the electricity so produced may serve either the factory or motors driving other power-service equipment, such as pumps or refrigeration compressors.

An attempt has been made to include most of the possible combinations found in industry, for example the supply of steam from a diesel engine by means of a waste-heat boiler (not shown).

ORGANIZATION of the power-engineering staff must match the responsibilities just outlined. The exact character of this power organization is something that top management willingly leaves to the power engineer. All they normally ask of him is that he deliver the required power services dependably and economically.

Recognizing the technical complexity of the power-service network, its essential character, and the money to be saved or wasted in its handling, wise management pays what it costs to hire a first-class power



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SOUND ORGANIZATION REQUIRES

THAT TOP MANAGEMENT . . .

1. Make the industrial power engineer completely responsible for generating and distributing power services of high quality at low unit cost

2. To this end give him complete control over selection of power equipment, fuel, supplies and personnel

3. Enlist the power engineer's help in cutting consumption, by metering services and by advising the heads of consuming departments

THAT THE POWER ENGINEER . . .

1. Let every man under him know his exact responsibilities

2. Encourage study, question asking, cooperation, preparation for emergencies

3. Demand neatness, scheduled maintenance, strict obedience to orders

4. Treat his men fairly, keep all promises, acknowledge help, reward merit

to another as well as to factory consuming de-nts. Thus, for example, the boiler may supply steam, also steam to run an engine. The nical power generated by the engine may drive ctrical generator, and the electricity so produced erve either the factory or motors driving other service equipment, such as pumps or refrigera-ompressors.

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ognizing the technical complexity of the power-network, its essential character, and the money saved or wasted in its handling, wise manage-pays what it costs to hire a first-class power engineer and lays all its power problems on his shoulders, along with full authority over fuel and equipment purchases and power-department personnel.

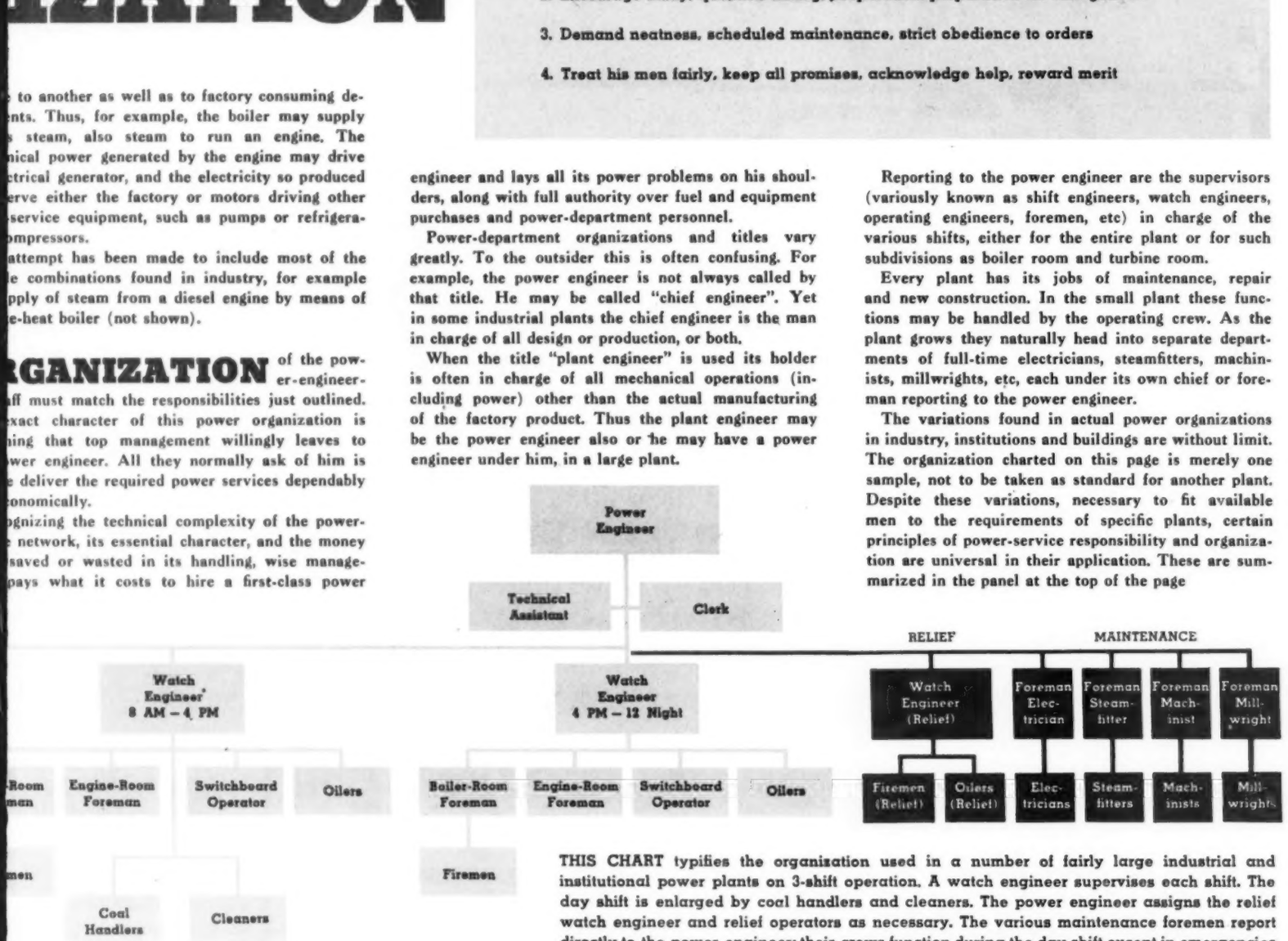
Power-department organizations and titles vary greatly. To the outsider this is often confusing. For example, the power engineer is not always called by that title. He may be called "chief engineer". Yet in some industrial plants the chief engineer is the man in charge of all design or production, or both.

When the title "plant engineer" is used its holder is often in charge of all mechanical operations (including power) other than the actual manufacturing of the factory product. Thus the plant engineer may be the power engineer also or he may have a power engineer under him, in a large plant.

Reporting to the power engineer are the supervisors (variously known as shift engineers, watch engineers, operating engineers, foremen, etc) in charge of the various shifts, either for the entire plant or for such subdivisions as boiler room and turbine room.

Every plant has its jobs of maintenance, repair and new construction. In the small plant these functions may be handled by the operating crew. As the plant grows they naturally head into separate departments of full-time electricians, steamfitters, machinists, millwrights, etc, each under its own chief or foreman reporting to the power engineer.

The variations found in actual power organizations in industry, institutions and buildings are without limit. The organization charted on this page is merely one sample, not to be taken as standard for another plant. Despite these variations, necessary to fit available men to the requirements of specific plants, certain principles of power-service responsibility and organization are universal in their application. These are summarized in the panel at the top of the page



THIS CHART typifies the organization used in a number of fairly large industrial and institutional power plants on 3-shift operation. A watch engineer supervises each shift. The day shift is enlarged by coal handlers and cleaners. The power engineer assigns the relief watch engineer and relief operators as necessary. The various maintenance foremen report directly to the power engineer; their crews function during the day shift except in emergencies

More Hp per Lb of Diesel—1

Scanning the past to estimate the future, Dr P H Schweitzer, Professor of Engrg Research, Pennsylvania State College, shows what has been and can be done to cut weight and boost output. In so doing, he presents an unusually clear picture of the diesel fundamentals every power engineer should know

▶ THE DIESEL ENGINE has made tremendous strides in the half a century since its invention in 1893. Numerous research and design developments have increased its relative power output, simplified its construction and reduced its cost so that it has grown steadily as a competitor of the gasoline engine on one hand and of steam on the other.

With what assets did the diesel engine start its career? What technical developments overcame its early disadvantages? What limits, if any, exist in regard to its future development? This article, and another to follow, present, in simplified terms, the answers to these questions—the basic characteristics of the diesel engine, how they compare with those of other prime movers, particularly the gasoline engine, and how they affect future engine development.

High thermal efficiency has always been a major diesel asset; in addition this efficiency holds up well at partial loads and in small engines, where efficiencies of other prime movers suffer. Against the gasoline engine the diesel enjoys the further advantage of burning a cheaper fuel, and one that involves less fire hazard.

The low fuel consumption of the diesel engine is due to its principle of operation, which is as follows: (1) the piston compresses pure air in the cylinder to about 500 psi, (2) fuel is injected at about top center position and ignites because of the heat generated by compression (about 1000 F), (3) the resulting pressure forces the piston down, producing torque.

In what follows the familiar gasoline engine is used for comparison. One can recognize the diesel engine by the absence of spark plugs and carburetor. The diesel has no spark plug because the air when compressed to about 500 psi becomes about 1000 F in temperature, which is more than enough to ignite the injected fuel. It has no carburetor because it compresses only pure air.

The diesel engine owes its high efficiency to the fact that its compression ratio is high, about 14:1. This means that the air is compressed to one-fourteenth of its original volume. This, in turn, means a high expansion ratio; the more a gas expands after combustion the more power it produces, hence higher efficiency. In the gasoline engine, compression ratio is limited. If compression pressure exceeds a given value for any given fuel, the mixture will ignite before compression is complete. Detonation sets an even lower limit. Thus compression ratio depends on the nature of the fuel; for ordinary automotive gasoline a compression ratio of about 6:1 represents a maximum.

It was mentioned that the diesel compresses pure air, not an air-fuel mixture as does the carburetor engine. Here is the secret of the diesel's fuel economy at part load. If the mixture in a gasoline engine is to ignite, air-fuel ratio must stay about 14.5:1. Thus to control such an engine, the operator throttles the intake charge. But this throttling increases the pumping loss (frictional resistance to flow of air) and reduces the compression pressure. Both affect fuel economy adversely. Furthermore, cylinder temperature remains about as high at part load as at full load and hence the percent heat loss goes up at part loads.

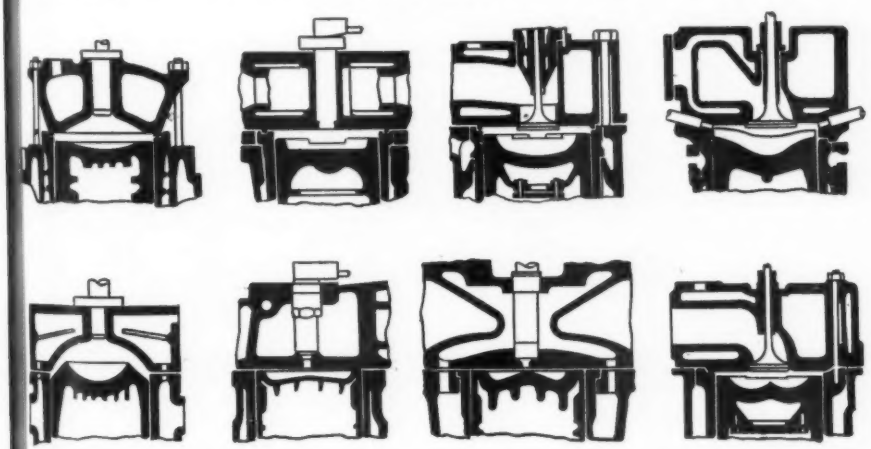
Diesel Air-Fuel Ratio

On the other hand, the diesel gets a full charge of air at all loads; only the amount of fuel injected varies. Thus in the diesel air-fuel ratio varies from about 20:1 at full load to as lean as 100:1 at idling, which compares with the constant gasoline-engine ratio of 14.5:1.

Why will a lean mixture ignite in a diesel and not in a gasoline engine? In the diesel, we do not have a *homogeneous* mixture but a *stratified* mixture. The injected fuel enters the cylinder in a spray consisting of a dense liquid core, a thin fog envelope and all kinds of gradations between. If the spray ignites at one or two points, the combustion spreads, the fuel combining with the air immediately around it. Therefore, a most important difference between a carburetor engine and a diesel engine is that in the carburetor-engine cylinder we have a more or less homogeneous mixture and in the diesel a stratified mixture.

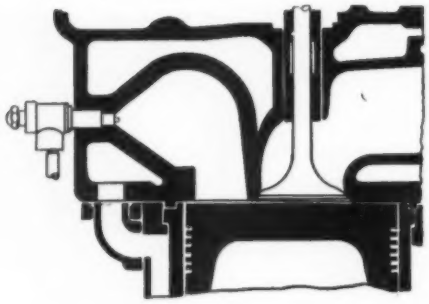
In view of the outstanding features of the diesel engine it may be surprising that the diesel has not displaced carburetor engines altogether. It is simpler, uses a cheaper fuel, and less of it. Its part-load economy is excellent. It is less fire dangerous. It can be built in large and small sizes. It is in order to point out that not all of the advantages are on the side of the diesel. In fact,

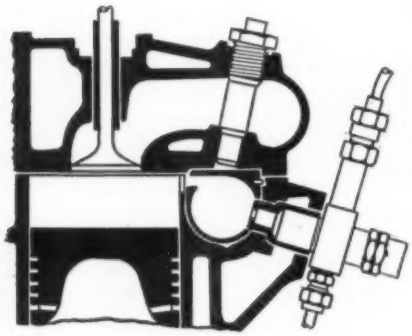
TYPICAL OPEN-COMBUSTION-CHAMBER DESIGNS



Used in virtually all low- and medium-speed engines, and in a few high-speed units, the modern open combustion chamber is shaped to fit the fuel spray, which usually comes from a multiple-hole nozzle. Shape and relation of cylinder head, inlet port or ports and piston crown are sometimes designed to provide some air turbulence

TURBULENCE CHAMBERS





In this design, all clearance volume above that needed to avoid mechanical interference lies in a chamber in the frame or cylinder head. Air forced into the chamber on the piston upstroke swirls rapidly; a single-hole nozzle injects fuel into this turbulent air, where burning begins and spreads rapidly

for many applications the diesel is decidedly inferior. For automotive use, an important factor is first cost, and for aircraft use, the weight per horsepower. For main propulsion of large ships the maximum horsepower which can be produced by a single unit is important. For any small power, starting ability must be considered. To judge the diesel's qualifications on these points we again must examine its basic principle.

The most significant difference between a carburetor engine and a compression-ignition engine lies in the nature of the charge. The carburetor engine deals with a homogeneous charge of air and fuel vapor of about 14.5:1 air-fuel ratio irrespective of load. In the diesel cylinder we have a heterogeneous or stratified charge, the mixture ratio of which varies from point to point, from very lean to very rich. The total air-fuel ratio is about 20:1 at full load and may go beyond 100:1 at no load.

A stratified charge with varying mixture ratio has its advantages and disadvantages. It is responsible for the good fuel economy of the diesel at part load; the air charge need not be throttled. The disadvantage lies in the fact that we either have to waste air or waste fuel because during the short time available all fuel molecules cannot be expected to find all oxygen molecules. If an engine runs at 1200 rpm (many run faster), the whole expansion stroke lasts only 1/40 second.

To burn the fuel efficiently, mixing should be complete in the early part of the expansion stroke. But injection and mixing cannot start much before the beginning of the stroke. So we have a time interval of the order of 1/100 seconds. Air and fuel cannot mix completely in such a hurry, not even if the fuel spray is perfectly atomized and distributed.

In burning, each carbon atom combines with two oxygen atoms, in the well-known combustion reaction

$$C + O_2 = CO_2$$

Similarly, two hydrogen atoms combine with one of oxygen

$$2\,H_2 + O_2 = 2\,H_2O$$

A diesel fuel may be represented by *heptane*, a hydrocarbon having the formula C_7H_{16}. In complete combustion this combines with 11 oxygen atoms

$$C_7H_{16} + 11\,O_2 = 7\,CO_2 + 8\,H_2O$$

The ordinary diesel fuel is not heptane, however, nor any single chemical compound, but a mixture of hydrocarbons. Its components are various hydrocarbon molecules and the fuel ultimately consists of nothing but carbon and hydrogen. The carbon-hydrogen ratio may vary between 6 and 8 (by weight), depending on the source and processing of the fuel. One lb of hydrogen requires 32/4 = 8 lb of oxygen for complete combustion and one lb of carbon requires 32/12 = 2.666 lb of oxygen. One lb of atmospheric air contains 0.2315 lb of oxygen and thus one lb of hydrogen will require 8/0.2315 = 34.5572 lb of air and one lb of carbon will require 2.666/0.2315 = 11.5191 lb of air for complete combustion.

One lb of an average diesel fuel that contains one weight of hydrogen to seven weights of carbon will require for complete combustion

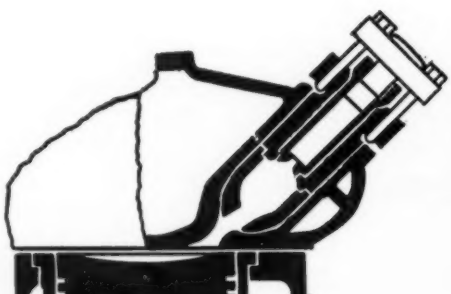
⅛ 34.5572 + ⅞ 11.5191 = 14.5 lb air

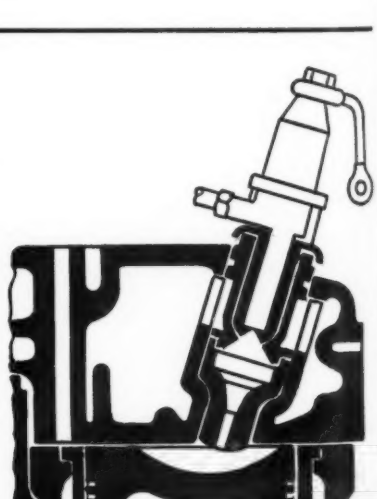
Therefore, if at the time of ignition the combustion chamber contains one lb of diesel fuel and 14.5 lb of air, completely mixed so that each fuel particle is completely surrounded with the corresponding amount of oxygen particles, the charge burns completely, with no fuel or oxygen left. The combustion products are carbon dioxide and water vapor (CO_2 and H_2O).

However, if the air-fuel ratio is chemically correct but the mixture is not perfect, the story is different. Fuel particles fail to find the corresponding oxygen molecules in the short time available, and at the end of the power stroke both unburned fuel and oxygen remain.

In a gasoline engine, the carburetor effects the mixing of fuel and air, outside the cylinder, and the entering charge represents a more or less homogeneous mixture. In a diesel engine we have a *heterogeneous* or a stratified mixture. A gasoline engine burns a chemically correct mixture without difficulty; a diesel engine cannot.

PRECOMBUSTION CHAMBERS



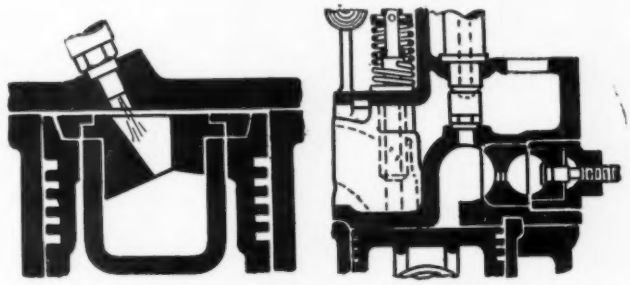


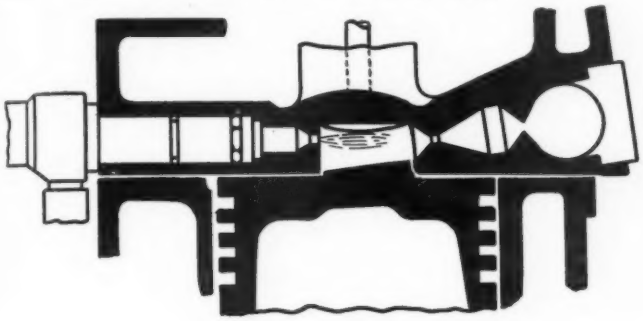
The precombustion chamber holds only part of the clearance volume, thus the injected fuel burns with insufficient air. The resulting explosive action ejects the remaining fuel and partially burned gas into the cylinder space at high velocity, creating a turbulent condition in which combustion continues to completion

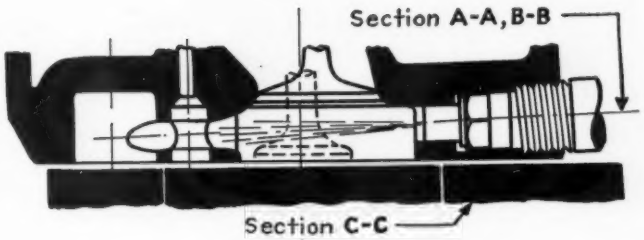
AIR-CELL AND ENERGY-CELL DESIGNS

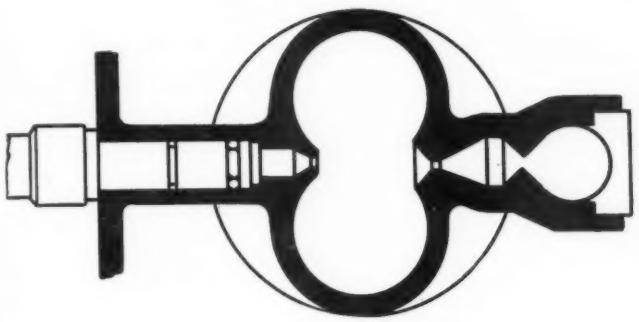
In the air-cell design, part of the combustion air is trapped in a pocket or cell in the piston or cylinder head. As fuel burns in the cylinder space, heat of combustion expands the air in the cell, causing it to jet out at high velocity, promoting mixing of air and fuel in the cylinder space. As shown at right, the air cell can be combined with a turbulence chamber

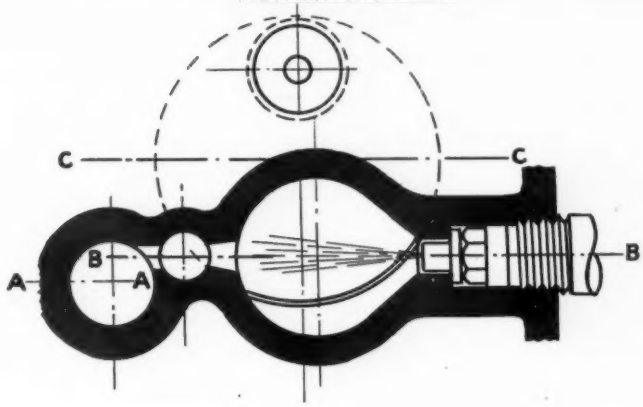
Energy cells differ from air cells in that part of the fuel enters the pocket into which air has been forced by piston action. This fuel burns in the cell, increasing the force with which the gas jets from the cell and so increasing the turbulence created in the cylinder space. More than half the fuel enters the energy cell, and peak pressure develops there











It may be helpful to compare the carburetor engine to a fraternity dance and the diesel engine to a barn dance. At a fraternity dance the men and girls arrive in pairs. All dating has been done beforehand. There is no confusion. Each is close to his date. When the orchestra begins they start to step at once and all have the round completed before the music stops.

At an old-fashioned barn dance the men and girls arrive separately and meet at the dance. Many do not even know their partners before and meet them only on the dance floor. Naturally it takes some time to get going and the first dance number may be finished with many participants still on the side lines.

Even if the number of men were exactly equal to the number of women and neither were choosy about partners, it would still be unreasonable to expect that the last man would find the last girl during the few minutes available. In an engine, only a few thousandths of a second are available.

The chances of the girls not becoming wallflowers would be better if their number were cut in half. That is what is done with the fuel in diesel engines. Reduce the fuel injected into the cylinder by about one-third below what would be permissible for a chemically correct mixture. Instead of using the chemically correct air-fuel ratio of 14.5:1, we use about 50% excess air, which boosts the air-fuel ratio to $1.5 \times 14.5 = 21.8$. In this way we waste air but save fuel. If we tried to burn the fuel in a chemically correct mixture, a good portion of the fuel would fail to meet the necessary air and would go out of the exhaust unburned.

Thus we see that need to mix fuel and air in a diesel-engine cylinder in an extremely short time means supplying an excess of air above the chemically correct ratio. The excess varies between 25 and 100% at full load, depending on how well the engine design promotes quick and thorough mixing. If air and fuel mix well and promptly, excess required is small; if the fuel droplets fail to reach the far and hidden corners and air pockets in the cylinder, or fail to mix intimately with the air encountered, the necessary excess is large. In any case, less than minimum excess air means unburned fuel, which results in high fuel consumption, smoke, sooting, and overheating.

This unavoidable excess air reduces the power that can be obtained from a diesel cylinder. If the engine cannot operate without, say, 50% excess air, it means that one-third less fuel can be burned in a diesel cylinder than in a carburetor-engine cylinder of the same size. Because both gasoline and diesel fuel have roughly the same heat energy per lb, about 19,000 Btu, the power output of a diesel runs about one-third less than that of a gasoline engine of the same size, speed, general design and efficiency.

But we have already seen that diesel efficiency runs considerably better than that of the ordinary gasoline engine,

(*Continued on page* 140)

600 MILES and 10,000 POUNDS

On the way from Minneapolis to Alton a 30-year old boiler gained 10,000 lb steaming capacity by picking up waterwalls and a new stoker. Frank S Rieder, of Plibrico Jointless Firebrick Co, shows one way of getting more boiler capacity

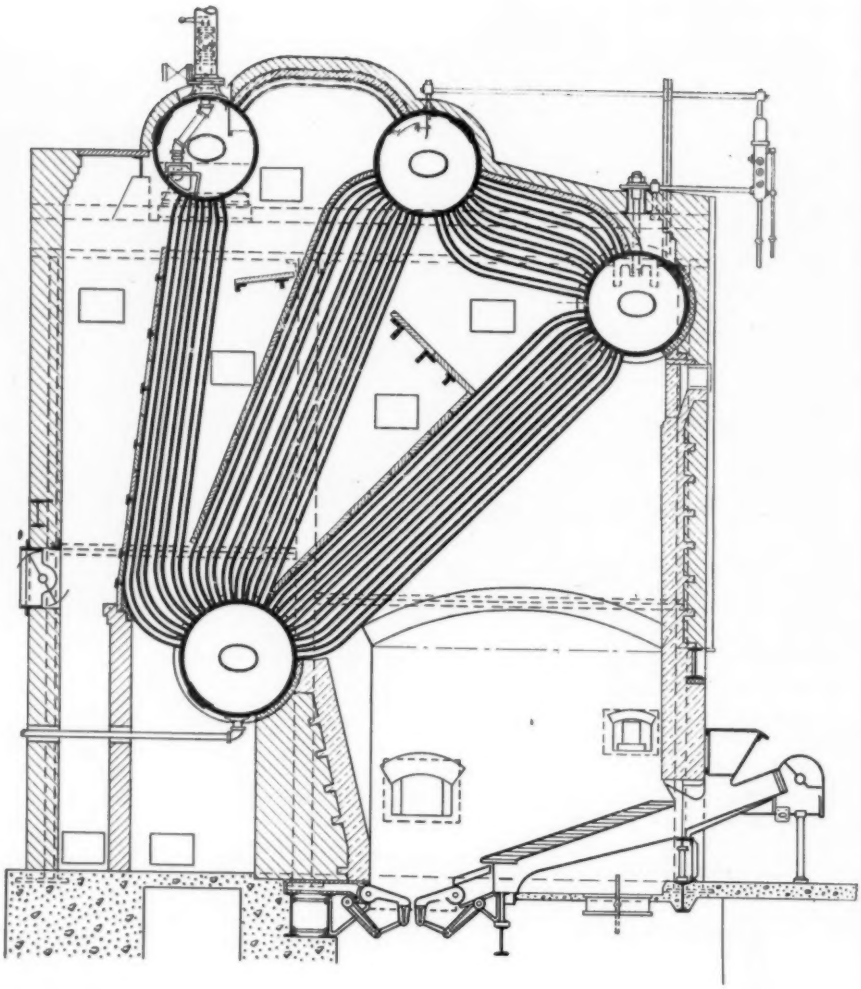


Fig. 1—Bought 1910, retired 1928, and modernized recently with spreader stoker, waterwalls, and larger furnace, this flour mill boiler now makes 40% more steam

▶ OLD EQUIPMENT REDESIGNED, altered or otherwise modernized can often approach the efficiency of modern units. Particularly is this necessary for boilers, because new ones are not readily available now. Improving furnace and baffle design and using modern fuel-burning equipment can yield increased steaming capacity, too. A recent experience of the Russell-Miller Milling Co illustrates how an old boiler was rebuilt and gained 40% more capacity.

In 1941 they acquired the Alton, Ill. flour mill of the Stanard-Tilton Co. While the factory itself is modern and efficient in most respects, the decidedly antiquated power plant boasted three old 3000-sq-ft watertube boilers, hand fired and set only 18 in. above the grates. To carry plant load, all three boilers had to struggle continuously.

New Boiler Meant Delay

A survey by Russell-Miller engineers showed that the Alton plant would have to have more boiler capacity. Buying a new boiler would mean delay and hard-to-get priorities for vital materials urgently needed for other war production. An old 25,000-lb-per-hr boiler, however, was available at their Minneapolis plant.

Before deciding to move the boiler, the engineers studied the possibility of increasing its efficiency. Suggested changes included rearranging baffles, installing waterwalls, increasing furnace volume, and using a modern stoker capable of burning economically the coal available at Alton.

The 5000-sq-ft Connelly (Foster Wheeler) unit equipped with a 5-retort underfeed stoker was originally installed at the Minneapolis plant, Fig. 1. Erected in 1910, it functioned until 1928 when the plant was partially electrified. The boiler was well cared for during its long period of idleness and is still good for 180 psi, although the Alton mill actually required only 150 psi. The original stoker, however, was in poor condition; many of the cast-iron tuyeres were burned out. Putting the old stoker in good operating condition would have cost as much as a new spreader stoker, which they installed. This was also considered more suitable for Illinois coal.

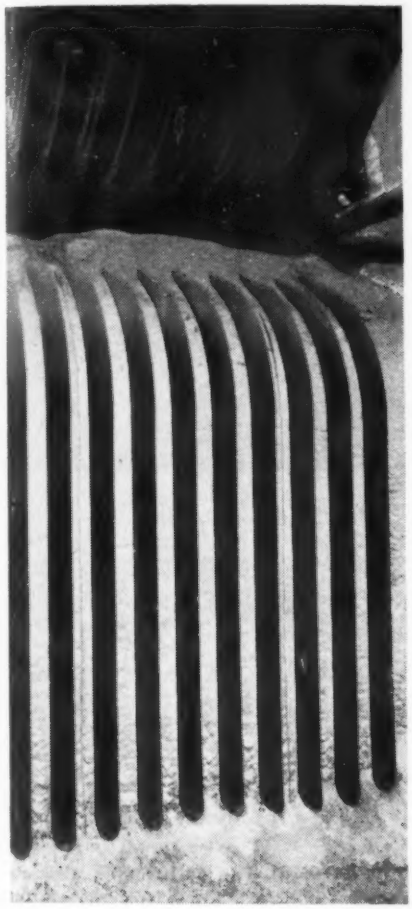
The boiler was removed from its suspension to Wm Bros Boiler & Mfg Co shops. Tubes were cut out of the drums, rebent, refitted, annealed and polished. Almost all the old tubes were usable so only a few new ones were necessary. Drums were inspected after sandblasting and new holes were drilled for waterwall tubes. Valves and fittings were inspected and repaired so that they were delivered at Alton in excellent condition.

More Heating Surface

Tubes were shortened about 4 in., which reduced the heating surface 100 sq ft, about 2% of the original 5000-sq-ft surface. New waterwalls, installed in the sidewalls and bridgewall, added 400 sq ft, giving a final heating surface of about 5300 sq ft. Waterwalls, exposed directly to the radiant heat of the fire, of course, add a great deal more to boiler capacity than the proportionate surface would indicate.

The boiler in the redesigned furnace

Fig. 2—Refractory covers waterwall tubes to the proper height for best furnace ignition temperatures and combustion of local Illinois coal. Rear wall tubes totally uncovered (photo below)



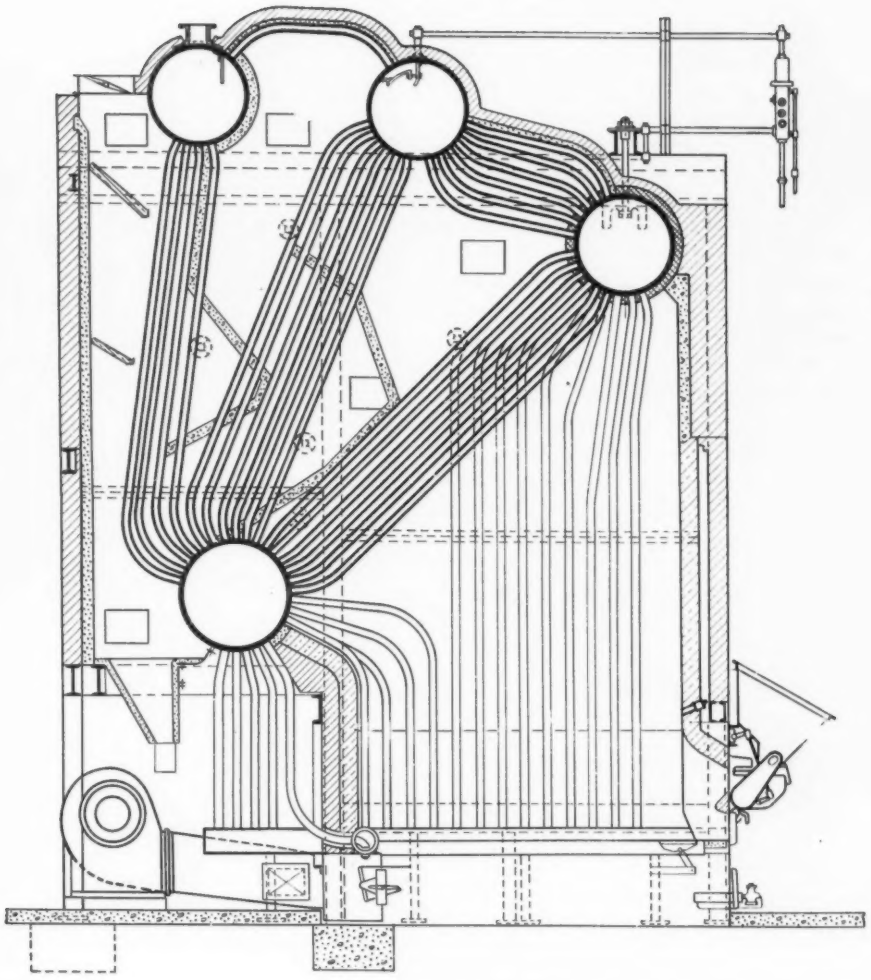


Fig. 3—A little steel for waterwalls, some cast iron for the stoker, and some noncritical refractory increased boiler output from 25,000 to 35,000 lb per hr

was raised about 2 ft by lengthening the supporting columns 3½ ft, strengthened with more backstays, for greater furnace volume. Adding waterwalls permits higher Btu release and operation at higher ratings without excessive deterioration of the refractory walls. As originally installed at Minneapolis, Fig. 1, maximum steam output of the boiler was 25,000 lb per hr, but as re-erected at Alton, Fig. 3, capacity jumped to 35,000 lb per hr.

At Alton, the boiler was provided with a Plibrico air-cooled and sectionally supported full-monolithic setting. New soot blowers were installed. Beco-Turner cross baffles effected a considerable improvement over the original ordinary parallel baffles.

Waterwall tubes were located on 10-in. centers to assure sufficient refractory surface for good ignition. Sidewall tubes were completely covered with refractory to a height of 4 ft above the grates, to give higher furnace temperature and to accelerate combustion.

The amount of refractory covering has a direct bearing on furnace temperature. In a heavily loaded furnace, temperature is normally high and the refractory covering can be quite low or omitted entirely; in a lightly loaded furnace, the waterwall tubes may be partially covered with refractory to maintain the desired temperature.

Final Results

The rebuilt boiler easily carries the entire Alton plant load formerly carried with difficulty by the three 3000-sq-ft boilers. One of the old boilers remains for heating when the rebuilt boiler shuts down at 6-week intervals for cleaning and inspection. The rebuilt boiler operates at an average rating of 150%, or about 25,000 lb of steam per hr, with peak loads as high as 200%. Fuel is No. 5 seam Saline County (Ill.) ⅞x⅜-in. washed coal, furnished by the Peabody Coal Co. Heating value as received is 12,150 Btu.

The prime mover at the Alton mill is a 1450-hp 26x52x48 cross-compound corliss engine, with an 18-ft diameter flywheel 6 ft wide. The Goodrich V-belt drive, believed to be the largest in operation, consists of 21 belts, each 2½ in. wide, 928 in. long, and 1¼ in. thick, operating from the engine flywheel to a 7-ft countershaft sheave, together with a 5-ft idler pulley on the bottom of the drive. The drive can transmit at least 2500 hp.

The engine, built in 1908 by the Minneapolis Steel & Machinery Co. was originally used at the Russell-Miller mill in Minneapolis. Like the boiler, it had been out of service for a long period. Before being moved to the Alton plant, it was dismantled, inspected and repaired and now runs perfectly. Electricity for lighting and supplementary power is purchased.

The Alton mill operates 24 hr per day, seven days a week, except at intervals when the boiler is taken out of service for inspection. The 4250-bbl daily capacity mills the yield from approximately 13,000 acres to produce twelve carloads of flour and five carloads of feed.

Modernization of power facilities at the Stanard-Tilton mill was carried out under the direction of Charles A Lang,

chief engineer of the Russell-Miller Milling Co and Earl A Rynearson, then chief engineer of the Minneapolis mill. Mr Rynearson is now acting as chief engineer of the Stanard-Tilton mill, at Alton. He is highly gratified with the improved performance of this boiler and considers that their efforts in converting it into a modern and efficient unit have been amply rewarded. This modernization not only saved the amount of metal necessary for a new boiler but it also reduces the fuel consumption below that which the original design would have required.

This instance of reconditioning and moving an old boiler illustrates ingenuity in conservation of materials and time during today's war emergency conditions. As such it can be an example of expediency to others. Let's hope for the day when new boilers can be had for the asking.

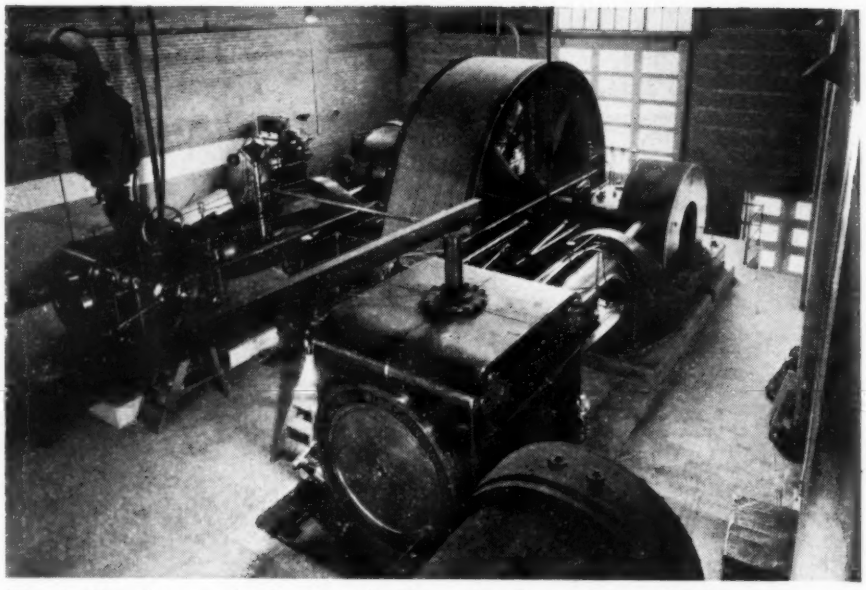


Fig. 4—Complete overhaul prepared this engine for useful work after many years of idleness. The 2500-hp V-belt is thought to be the largest of its kind

Compressors Under Test Lick Air Shortage Threatening Production

Additional air for Schramm, Inc, now comes from compressors on test with no time out from the test floor, says H J Schramm. Here's a suggestion for putting other manufactured equipment to work when expanding production demands an increase in any phase of power

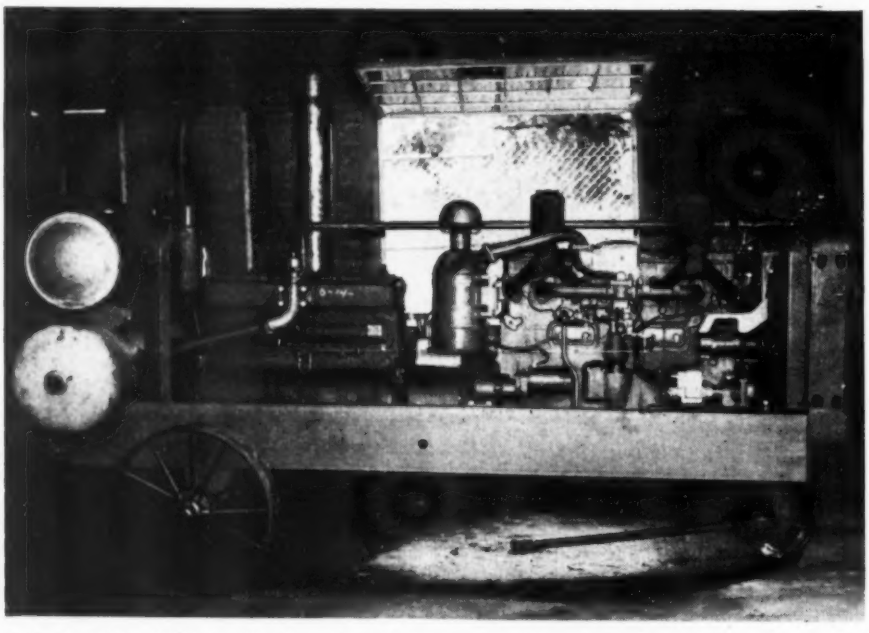


Fig. 1—This 315-cfm diesel-engine-driven compressor, located under a three-sided shed, is furnishing air to the shop during preliminary running-in load tests

► LIKE THE SHOEMAKER'S CHILDREN who were always without shoes, we ran into a shortage of compressor capacity for shop service. Because war plants urgently need air compressors, we are constantly increasing our production and as it expands, shop demands for air increase. Accordingly, we were faced with the difficult problem of finding enough air capacity.

Electric Load Increased

Our original installation consisted of motor-driven compressors, but as many new and larger production machines throughout the shops increased our transformer load, we replaced motor-driven stationary compressors with either gasoline- or diesel-engine-driven outfits. At first we used trade-in units and compressors returned from rental service. Under that plan, we could put such units on the line for two or three months to observe their

operating efficiency before delivering them to the service department for general overhauling as used machinery. It quickly became apparent, however, that customers were constantly requisitioning these rental or used compressors for rush jobs at a time when we needed them to provide air for our shops.

Next, we tried using on our air lines compressors that were in various stages of experimental and developmental work. They were both used and new compressors, being developed with experimental gadgets or design improvements that were later applied to our standard units. After a considerable test in the shop, the experimental compressors were placed in the field under actual operating condition. Thus, a change in their setup once more caused a shortage of air for production.

Finally, the problem became so serious that it demanded a definite and logical solution. As a result, our procedure now is to use a gasoline- or diesel-driven portable compressor as it comes off the assembly line to the test line where it is given a preliminary setting and run-in. After the preliminary period, the compressor is connected to the shop air line.

This Procedure Worked

The machine furnishes air to the shop until the first unit of the second group comes off the assembly. The unit from the first group is then removed and given a final checkover test. The extra 25 or 30 hr that it has been running on the shop line provides an extended operating spot check for each group.

The first compressor of the second group is then connected to the air line and remains until all other units in its group have been fully tested; by that time the first of the third group comes through and becomes the last of its own group to go through the finishing tests. This does not mean that one open shop order waits for one group to catch up with the other, nor that a set of material is waiting to be put on the compressor after it goes through the final test procedure.

When additional air is required for special sandblasting operations, spray painting or breaking up concrete for some maintenance job, two compressors are hooked to the air line and the same procedure followed. Thus, instead of wasting gasoline or fuel oil and discharging air to atmosphere, this method puts machines to work and gives us the opportunity to spot check each group of units by putting one machine to an extra fullload test. Of course, the regular routine tests give more than enough time for faults of all other compressors to show up and be corrected. The compressor hooked to the air line really receives a supertest, as representative of its particular group. This procedure has made it unnecessary to provide additional electric transformer installations, which are not only difficult to obtain today, but which will not be needed when production schedules return to normal.

Whenever demand for air in some part of the shop exceeds regular capacity, a portable compressor is taken right to the job. It is hooked up to the nearest air line and operated outside the building involved. In such instances, we cannot always use the full power production from our compressors. However, this method does effect quite a power saving at a time when increasing power demands become a critical problem. Our procedure is similar to that followed by some manufacturers who build aircraft engines, which are direct connected to generators that feed electric power back into the plant distribution system during the engine test runs.

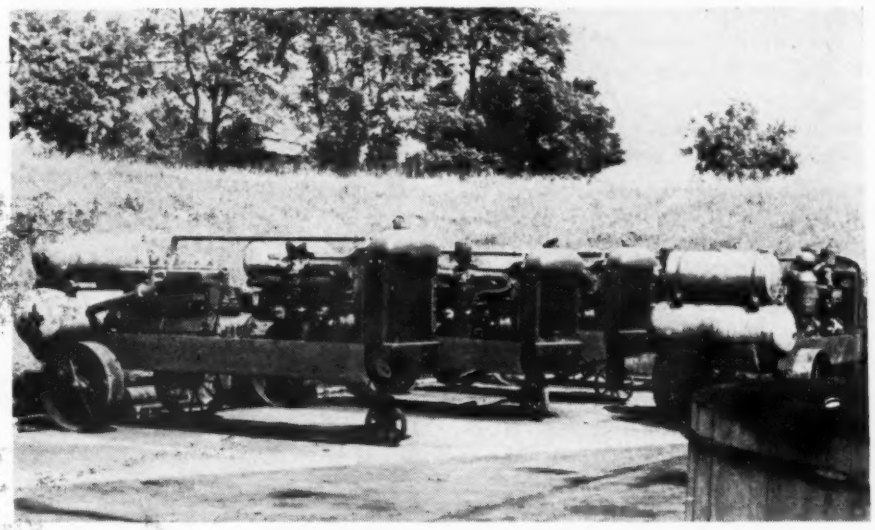


Fig. 2—Remaining units of the group receiving their check tests and final adjustments. Each compressor then gets an orifice-discharge test to check its capacity

Pointers For Operators

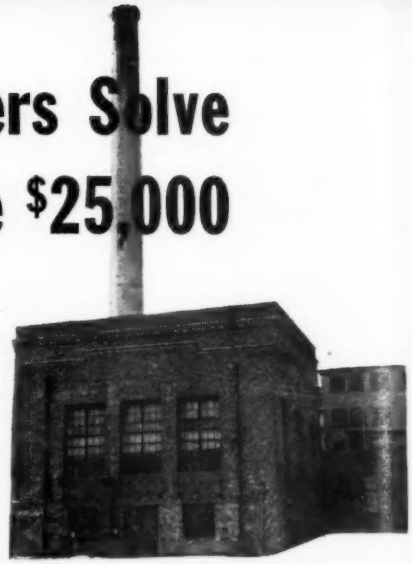
Safety valves. The safety valve on a superheater should be set to release before the safety valves on the boiler, so that in case of a sudden drop in the demand for steam, the superheater safety valve will relieve the excess pressure first, thus continuing the flow of steam through the superheater and preventing its overheating.

Oil pump steam supply. The steam supply line to the auxiliary oil pump for a steam turbine should be connected to the steam header on the boiler side of the stop valve which shuts off the steam to the main throttle valve for the turbine. Then if something happened to prevent closing the throttle valve, the turbine could be removed from service by closing the main stop valve without shutting down the auxiliary oil pump. This would permit the turbine to come to rest with ample lubrication of its main bearings, supplied by the auxiliary pump.

Foundation bolts. When a foundation bolt of a horizontal steam engine works loose, a very careful investigation should be made to determine the cause of the trouble. Frequently, local softening of the grouting under the engine base or frame by oil-soaking causes the looseness. Possibly the foundation has cracked or settled, so that it does not support the engine frame uniformly. Hence, the tightening of loose foundation bolts is inadvisable until the cause of the looseness has been determined and corrected; otherwise, it is very likely that such tightening will subject the frame to dangerous stresses which may cause it to crack.—*The Locomotive.*

Pneumatic Spreader Stokers Solve Conversion Problems, Save $25,000

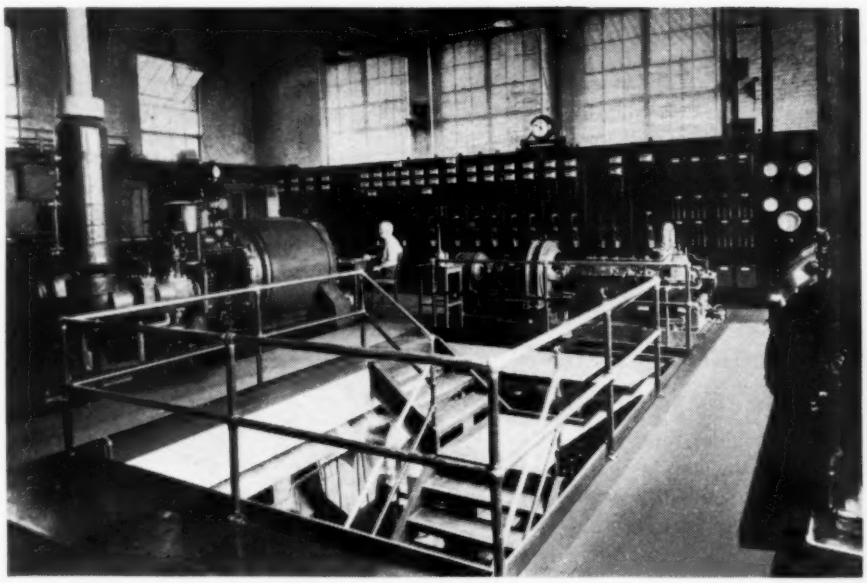
Bin-feed units, lifting coal 32 ft from basement storage pit to boiler room on second-floor level, eliminate need for complicated coal-handling and storage equipment at recently converted plant of Hunt-Rankin Leather Co, Peabody, Mass.



By WILLIAM MACMICHAEL, *Industrial Engineer*
Iron Fireman Corp

► WHERE TO STORE COAL, how to handle it from storage to boiler, how to remove and dispose of ash?—these and similar questions plagued the thousands of New England power engineers facing the problem of converting from oil to coal. Making the necessary changes in plants designed, in many cases, for oil firing only, and doing it in the face of strict limitations on equipment and material, meant makeshift arrangements in many cases and expensive changes in others. By selecting pneumatic spreader stokers, Hunt-Rankin Leather Co, of Peabody, Mass., avoided both difficulties, obtaining an efficient coal-fired setup at a substantial saving in first cost.

Manufacturers of high-grade leather for shoes and handbags, this company was one of the first in the Peabody district to cooperate with the government by converting; by so doing they made a contribution of 700,000 gal of fuel oil per year, and insured continued full-capacity production of materials essential for the war effort.



Three turbines furnish electrical power: On the day shift units operate condensing and extracted steam supplies process; at night one unit operates non-condensing

Boiler-Plant Equipment

The boiler plant at Hunt-Rankin consists of four 2500-sq-ft hrt units, each originally equipped with an oil burner of sufficient capacity to develop 200% of boiler rating, or to generate 17,250 lb of steam per hr. Boiler equipment includes Bailey steam- gas- and air-flow meters, stack dampers and full-floating control. Two boilers carry normal plant load, leaving two in reserve for plant expansion or emergencies. The boiler room is at the second-floor level (see photo of exterior above).

Power-generating equipment includes a 600-kw GE extraction-condensing turbine, a 250-kw GE unit and a 30-kw DeLaval machine. The plant operates 24 hr per day and because the day-shift load is heaviest, the plant then runs condensing with extraction steam supplying process demand. For lighter night-shift loads, non-condensing operation proves best; exhaust steam is used for heating and drying.

When it was decided to convert this plant to coal firing, these problems had to be faced: (1) The only available outdoor storage space for coal was about 250-300 ft from the power house, (2) the only way to bring coal to the plant was by truck, and (3) the underside of the boiler-room floor stood 13 ft 6 in. above the first-floor level. It looked as if an extensive conveying system and overhead bunkers would have to be installed unless resort was had to some makeshift arrangement suitable only for a short-lived emergency. A conveyor and bunker system satisfactory for permanent use would involve critical materials and equipment and it was questionable whether such a setup would meet with the necessary WPB approval.

G J Harrington, Hunt-Rankin president and a graduate engineer, solved the problem by installing a 1750-lb-per-hr Iron Fireman bin-feed pneumatic spreader stoker on each of two boilers. Excavating a pit 10 ft deep and 30 ft square under the first floor level provided storage space into which trucks can dump coal directly. The stoker units transport coal pneumatically from this storage to the boilers above, a total lift of 32 ft, the highest yet obtained with stokers of this type. It is estimated that this setup saved approximately $25,000 in first cost.

How Conversion Was Made

The diagram and photos on the facing page show some details of this unusual installation. The Iron Fireman pneumatic spreader stokers are designed to handle efficiently low-grade bituminous, sub-bituminous and lignite, as well as high-grade bituminous and

semi-bituminous coals. A steel worm draws coal from the storage space and delivers it to the transfer housing. A 1½-hp 1800-rpm ball-bearing motor drives the feed worm through a Reeves variable-speed pulley and gearing.

A specially designed fan, having a static pressure of 13 in. H_2O at maximum speed, draws hot gas from the boiler furnace through a 6-in. pipe. The fan also draws in room air; proportions of air and hot gas are regulated to give the desired temperature, which is governed by the coal's moisture content and will run between 300 and 850 F. The air-gas mixture picks up the coal as it is delivered to the transfer housing and blows it up through a 3½-in. coal-conveyor pipe to the stoker nozzle. The nozzle spreads the coal over the grate; distribution blocks in the nozzle insure complete coverage of grate surface. A 2-hp 3600-rpm ball-bearing motor drives the hot-gas fan.

A fan driven by a 3-hp 1800-rpm sleeve-bearing motor supplies underfire air. At maximum speed the fan develops a static pressure of 0.75 in. H_2O and delivers 3⅓ cfm for each lb of coal burned. Design of the bridgewall is such that part of the underfire air emerges through a row of ports on the bridgewall face. The stream of air, gas and coal from the stoker nozzle enters the furnace at right angles to the flow of underfire air coming up through the fuel bed; air emerging from the bridgewall ports converges with the air-gas-coal stream and the underfire air to create the turbulence necessary for efficient combustion.

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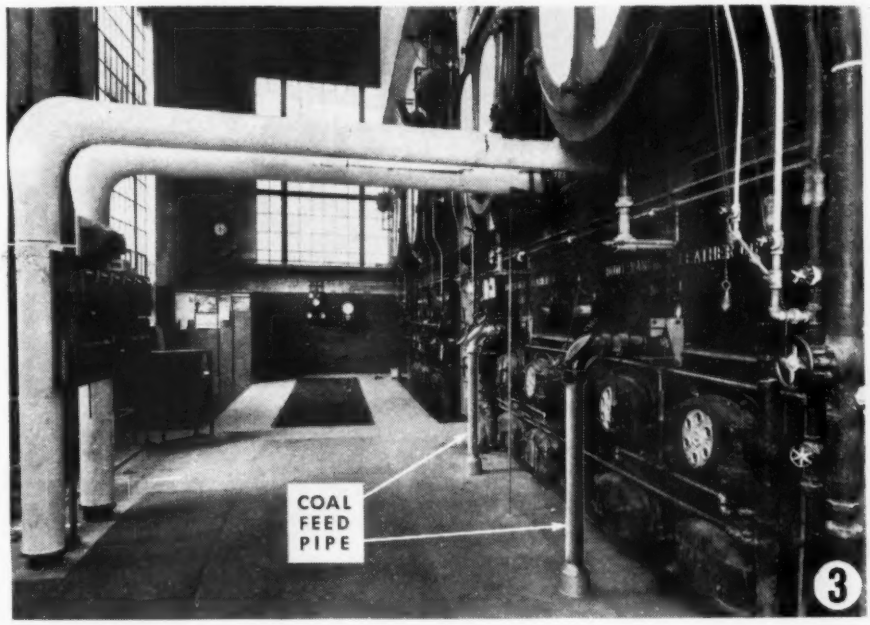
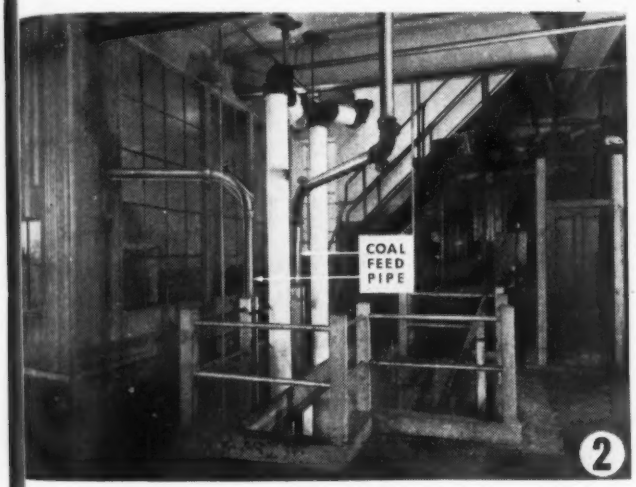




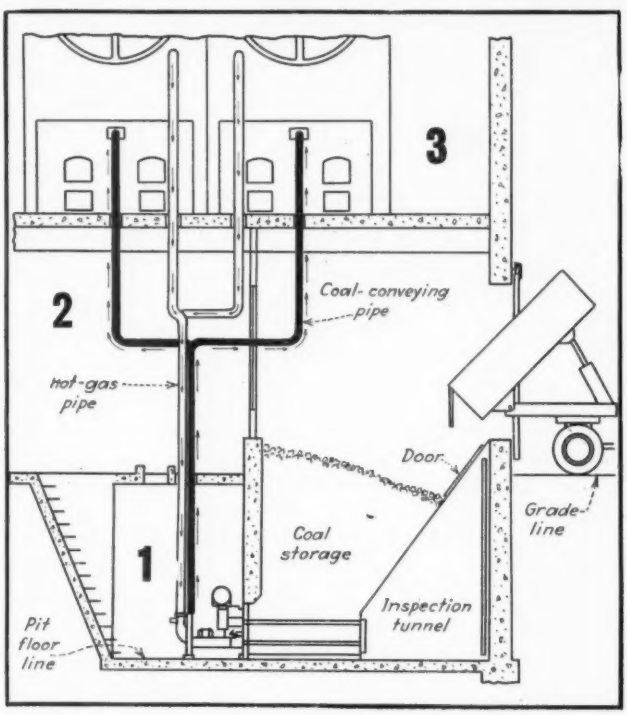
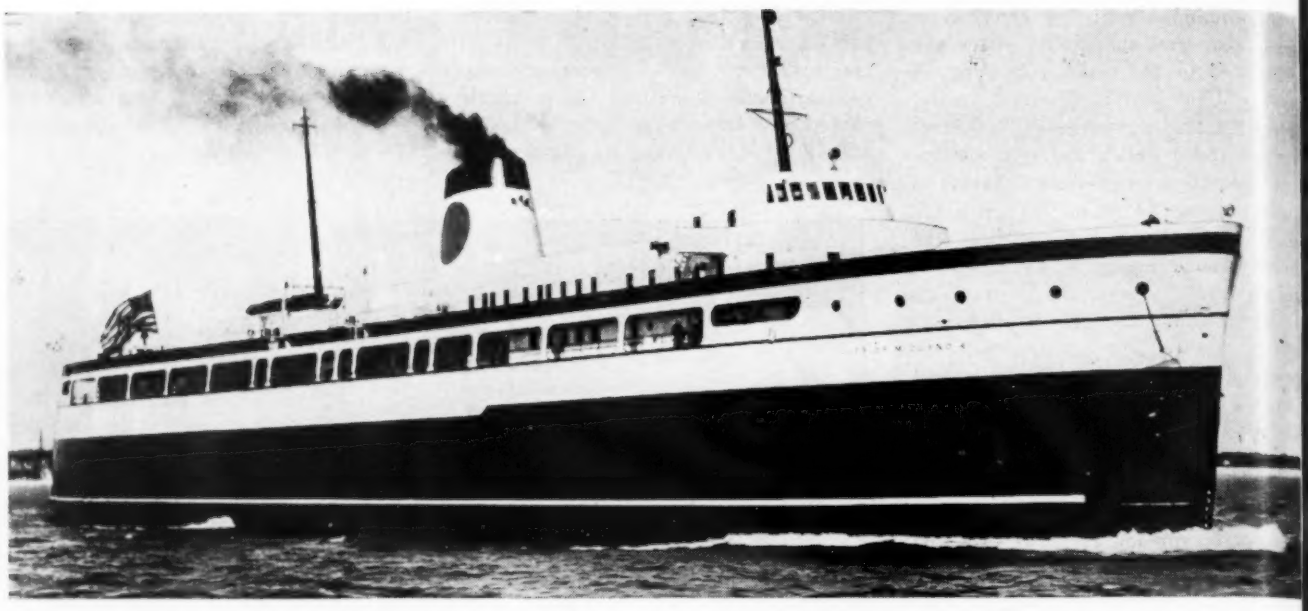


Diagram above shows coal storage in pit accessible from grade level, feed screws and transfer housings at pit level, and hot-gas and coal-conveying pipes leading to boilers on second floor. Numbers on diagram identify photo locations. Photo 1 shows hot-gas fans, control linkage, counterweights and jackshaft. In Photo 2, coal-feed and hot-gas pipes pass through first floor on way to second floor boiler room, Photo 3. Note convenient control panel on left side of boiler firing aisle



Reciprocating Engines for Marine Power

Widespread interest in steam engines has been aroused by their use in cargo and other vessels. K W Van Eman, Skinner Engine Co, describes a marine version of the modern unaflow, a dependable source of large horsepower for ship propulsion

► FOR OVER HALF A CENTURY little or no attempt has been made to improve the economy of the conventional marine steam engine. Unaflow engines, available and widely used for stationary purposes for about 30 years, have only recently been utilized for ship power.

In conventional triple-expansion engines, such as power Liberty ships, steam is admitted to the high-pressure cylinder for part of the stroke by eccentric-operated valves. Exhaust from high-pressure to successively lower pressure cylinders also is timed by ecentric-controlled valves.

In the unaflow engine, steam at full boiler pressure and temperature enters the cylinder at the ends after passing through steam-jacketed heads. After cut-off and expansion have taken place, steam exhausts directly to the condenser through ports arranged around the center of the cylinder which are uncovered by the piston at the end of the power stroke. Because the unidirectional flow of steam in the cylinder practically eliminates loss due to "initial condensation" the entire expansion to condenser pressure can be economically accomplished in a single cylinder.

These engines have an unusually flat steam-rate curve from below half speed to above full speed. They run with the throttle wide open at all speeds and with all power outputs, control being obtained entirely by changing the cutoff.

Two of the largest unaflow marine engines built by Skinner Engine Co, Erie, Pa., drive the big twin-screw freight-car, automobile and passenger ferry *City of Midland* between Ludington, Mich., and Manitowoc, Wis. These 5-cylinder 25x30-in. units have a combined normal rating of 6000 shaft hp at 120 rpm on 325-psi 640-F steam and 26-in. vacuum. They are capable of considerably more than their 7000-hp overload rating at 125 rpm. They have established records for low maintenance cost, high economy and good maneuverability. Tests have indicated more than 94% mechanical efficiency.

Similar construction has been applied to more recent units, Fig. 1. The engines are entirely enclosed with all bearings lubricated by a pressure oiling system operating at about 50 psi. Two sets of motor-driven herringbone-gear pumps supply the oil, one set being normally in service and the other standby. Crankcases are pumped dry with the suction controlled by an automatic float valve.

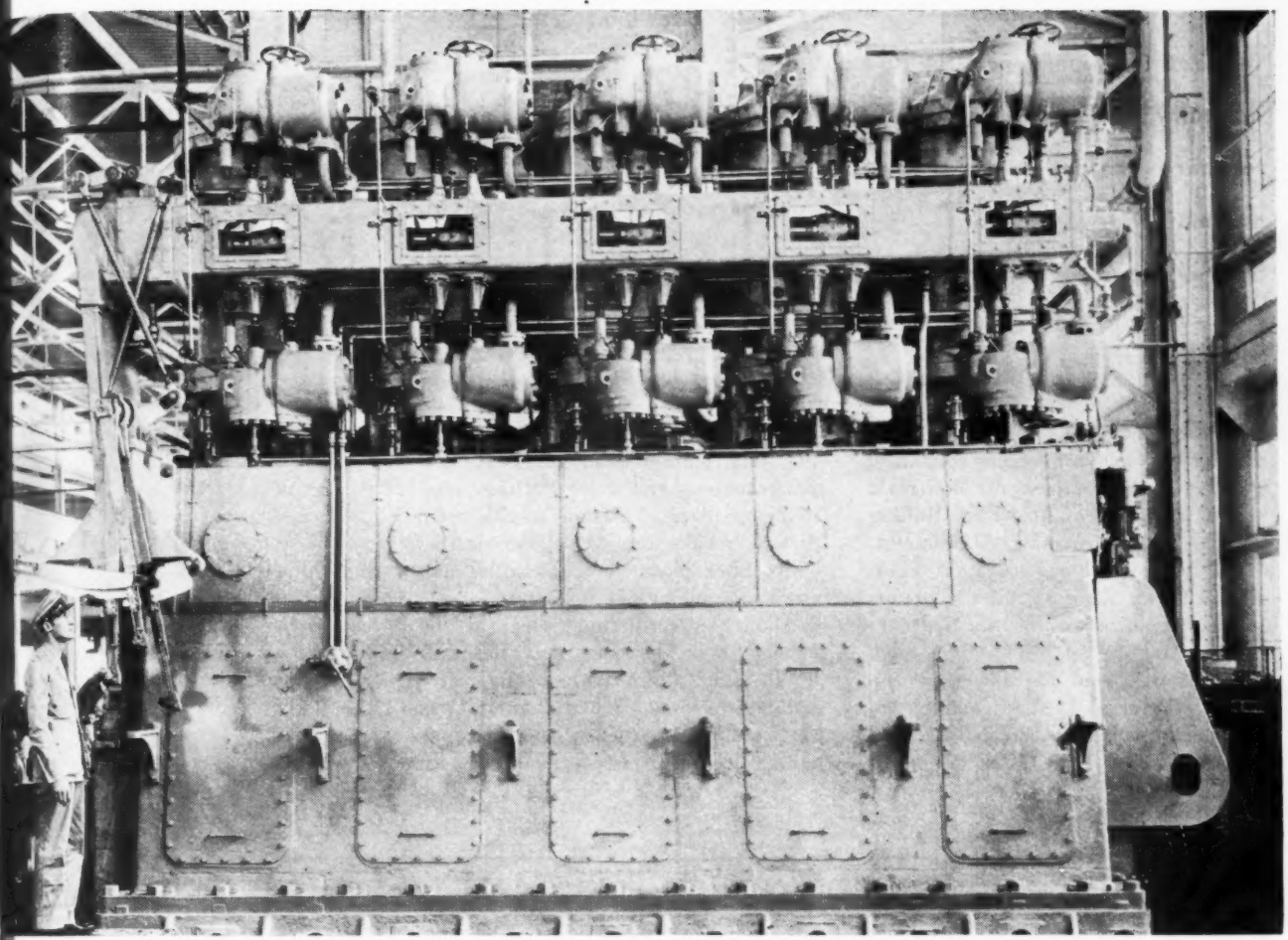
There are no oil cups of any kind on these engines as all moving parts, except the pistons, are lubricated from the oiling system. Oil circulates in a closed cycle through a cooler and strainer. Records indicate use of an original charge of oil for periods as long as three years, with only small additions of makeup.

Controls are mounted on the inboard sides of the main frames. The shortest of three levers connects to the cast-steel balanced throttle valves mounted on the outboard side. Two longer levers control cutoff ahead and cutoff astern, each swinging in the direction the ship will move. A small lever on the side of the frame operates an oil valve for hydraulically opening and closing all drip valves simultaneously.

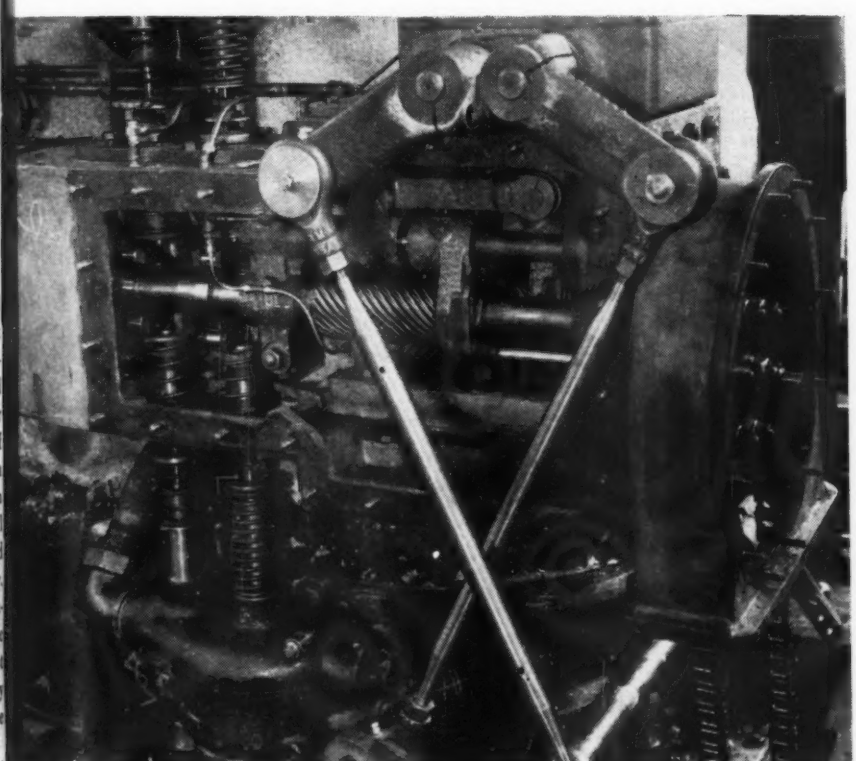
Each engine is fitted with expansion compensating steam manifolds on the outboard side. All cylinders exhaust to a common manifold connected by two 24-in. outlets to the condenser (one for each engine) mounted outboard.

Electric tachometers indicate speed on a single gage board hung between

(*Continued on page* 148)



g. 1—Large 5-cylinder unaflow for marine propulsion can develop high overload capacity when required. Note simplicity of lve control gear at left and single hydraulic valve for opening all cylinder drains mounted on the side of the engine frame



ig. 2—Admission and cutoff cams at left are driven by roller chain from the crankshaft hrough helical gears on a splined shaft. Lengthwise positioning of helical gears deter- ines valve timing by shifting position of cams earlier or later

Fig. 3—Single-piece connecting-rod forging is bored through its entire length to carry oil to bearings, guide and shoe

Practical suggestions for creating emergency capacity . . . substitutes for hard-to-get parts and materials . . . cures for overloads, break-

WARTIME POWER CLINIC

downs . . . ways to bui up short-handed staf Share your ideas! Se in your rough notes a photos or sketches. Pa ment at regular rat

ARMCO MEN FIGHT STEAM FROM BIG BROKEN MAIN

▶ IT WAS PITCH DARK when a window-rattling roar and a towering column of steam signaled failure of the main steam line of the American Rolling Mill Co's East Works, Middletown, Ohio. As pressure gages sagged, workmen came on the run and the plant's defense organization was startled into an alert.

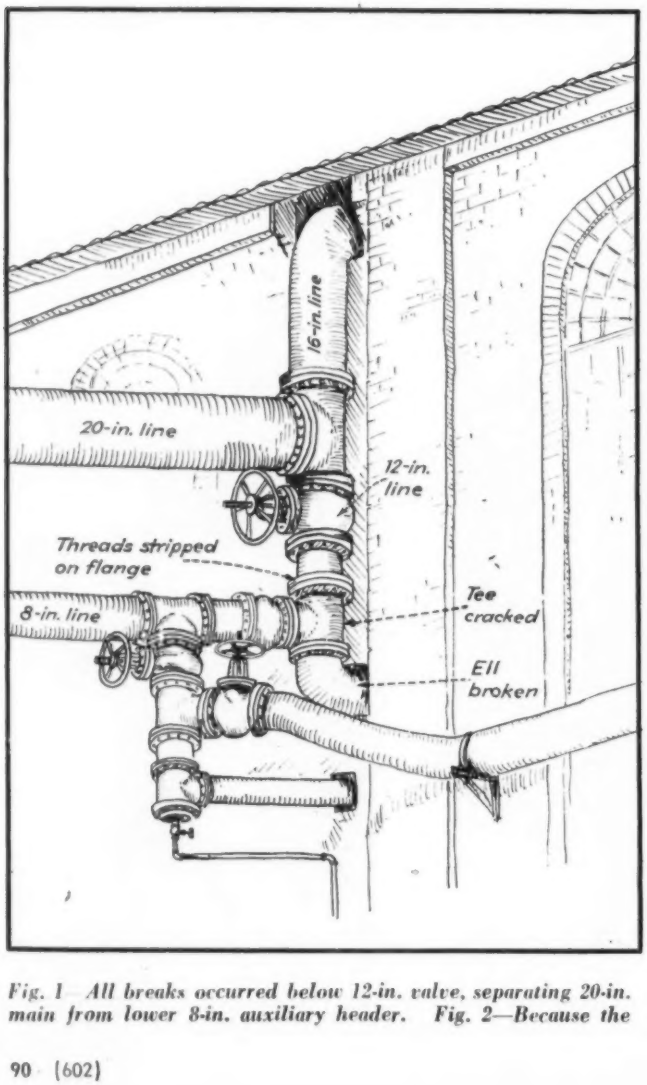
Clouds of steam hid the valve assembly, shown in sketches and photo, but later investigation revealed the condition shown in Fig. 1. Nothing was wrong above the upper valve, separating the 20-in. main (connecting boiler and powerhouses) and the lower 8-in. auxiliary header. All the breaks were directly below this valve, one in the 12-in. filler piece, one in the tee and one in the elbow.

About the only thing clear at the moment was the fact that the mill would shut down unless the valve could be closed. The situation was tough: darkness, the ear-splitting roar and the cloud of hot steam completely blanketing the valve assembly 25 ft in the air.

The men of the pipe shop held caucus. They developed a safe plan action before a valve was turned. Th ears plugged with cotton, their fa and hands bundled in cloths and hl cooled by compressed air from an hose, they climbed the ladder a working entirely by sense of touch the dense cloud of steam, they m aged to turn off the 12-in. valve.

After rerouting the steam from

Before and after views, reproduced directly from original sketches by Bernard A. Kealing, Armco Engrg D



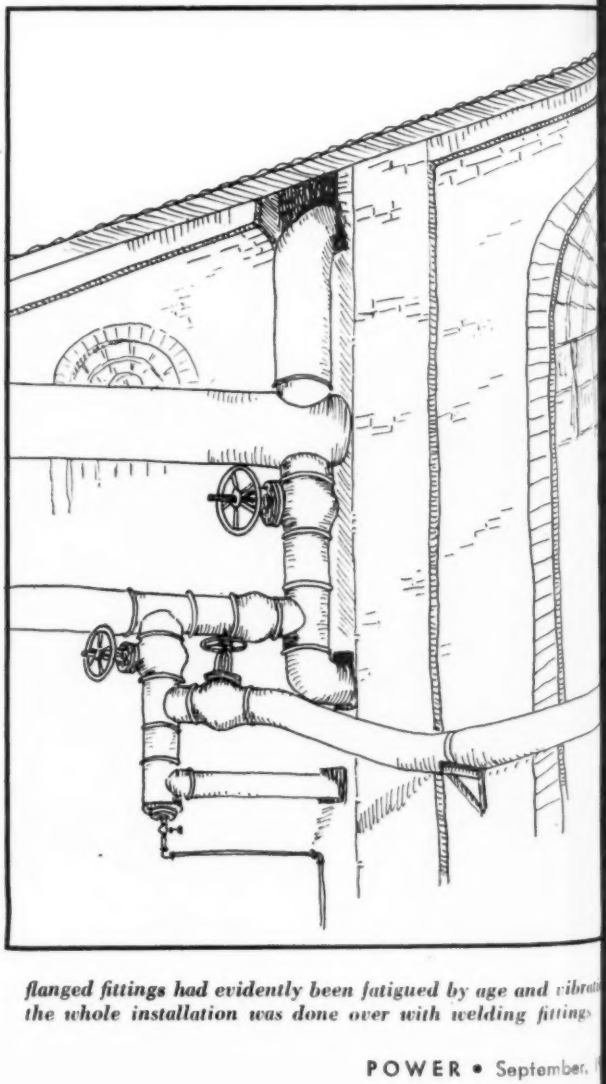
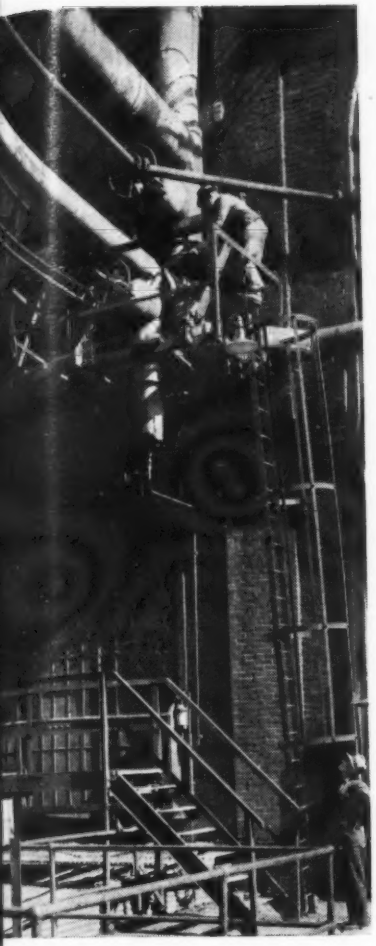


Fig. 1—All breaks occurred below 12-in. valve, separating 20-in. main from lower 8-in. auxiliary header. Fig. 2—Because the flanged fittings had evidently been fatigued by age and vibra the whole installation was done over with welding fittings

Fig. 3—Fini on of upp losed by ha

uxiliary l perations i ecided to elded con en install owed tha the flang used the Fortunate ere at ha air. The ormal ser ain uppe welded c eekend. Fig. 2 sh ruction us e comple For "ou rmco's n eorge M e followi e steam l carpent oung, a ombs, plu tter helpe raft, Loui lbert Tan



ig. 3—Finished repair job. Note posi-on of upper valve (above man) that losed by hand in a cloud of hot steam

uxiliary header so as to maintain perations in the mill, the repair crew ecided to replace all flanges with elded construction. This piping had en installed in 1910, and the evidence owed that age and vibration fatigue the flanged piping and fittings had used the failure.

Fortunately, steel welding-neck valves ere at hand to permit immediate re-ir. The lower header was back in ormal service in 17 hours, and the ain upper header was changed over welded construction on the following eekend.

Fig. 2 shows the type of welded con-ruction used in the repairs; the photo, e completed job after reinsulation.

For "outstanding war production" rmco's management presented the eorge M Verity Medal of Merit to e following nine men who repaired e steam line: Frank Wendt, foreman carpenter and pipe shop; Frank oung, assistant foreman; Clyde ombs, plumber; Robert Tewart, steam tter helper; Blaine Trent, Melvin Ash-raft, Louis Kiss, Robert Price and lbert Tannreuther, steam fitters.

Motor Pinch-Hits for AC Generator

► OUR EXPERIENCE IN PUTTING an old motor to work may give other companies a suggestion for emergency use of discarded or obsolete equipment lying around their plants. We needed a belt-driven alternator. Since we had two synchronous motor-generator sets not likely to be used again, we turned our attention to one of them.

The largest unit, a 3-bearing set, consisted of a 400-hp 2200-v 3-phase 900-rpm synchronous motor driving a 300-kw 250-v dc generator. We dismantled the generator and removed the armature from its shaft, replacing it with a multiple V-belt sheave.

Excitation for the synchronous motor was originally from the 250-v dc generator. As this source was no longer available, we dug up a 5-kw 125-v dc generator, which we installed so as to be driven by V-belt from a sheave on the outboard end of the motor shaft.

The synchronous-motor-field coils were connected series, as in Fig. 1, for 250 v. To make the field-coil circuit suitable for 125 v, we connected the coils in two series groups and put the two groups in parallel, Fig. 2.

In making this connection, we grouped all *N* pole coils in one series and all *S* pole coils in another. We did this so that, in case one circuit opened accidentally, the remaining coils would produce consequent poles of the proper polarity and give equal distribution of the magnetic flux. Also, if for any reason more current flowed in one circuit than in another, the field flux would

(*Continued on page* 166)

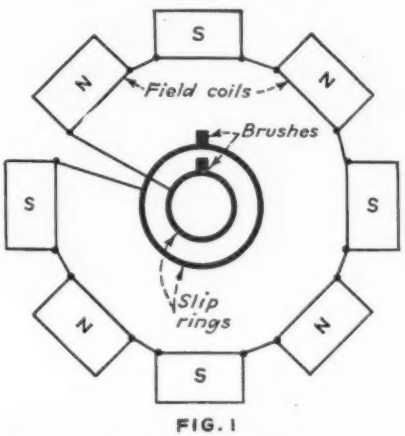


FIG. 1

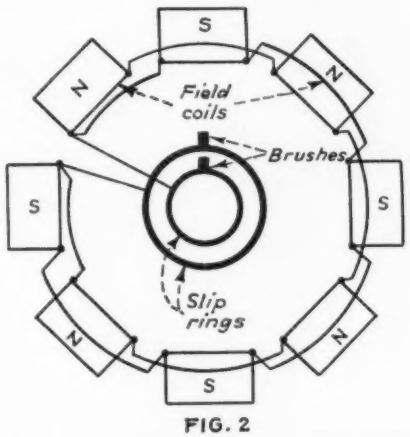


FIG. 2

Fig. 1—Field coils were originally connected in series for 250-v excitation current. Fig. 2 Reconnection of field coils in 2 parallel groups, one group of north poles and one of southpoles, allowed 125-v excitation and gave special protection (See text)

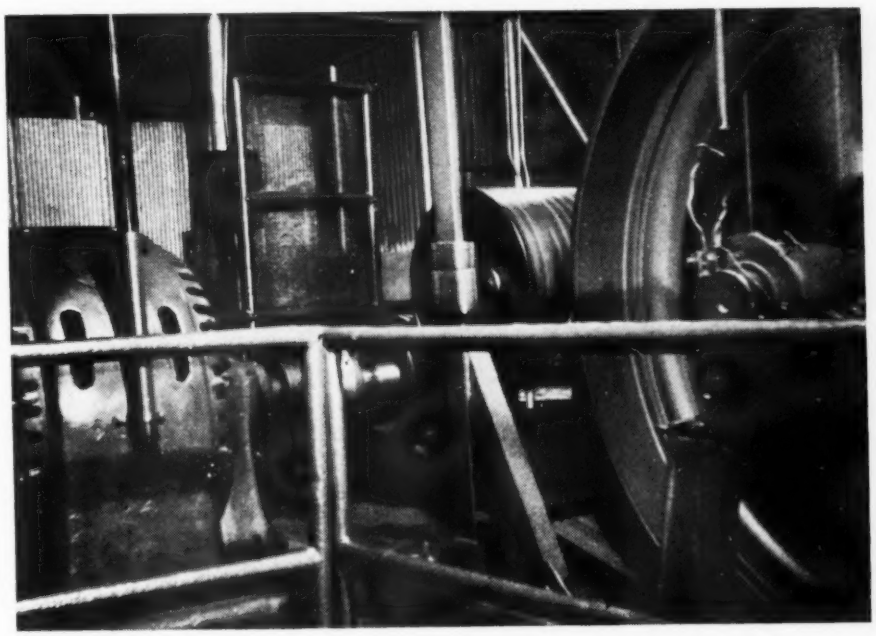
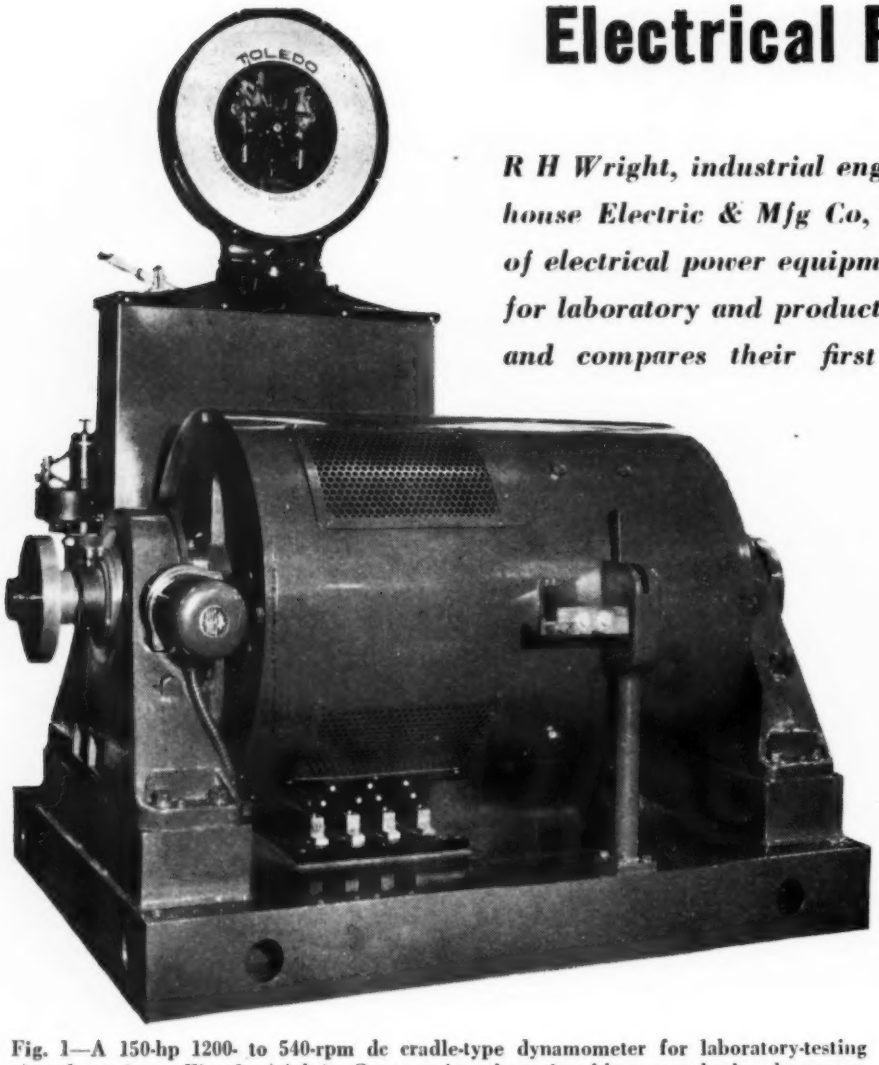


Fig. 5—Alternator made from synchronous motor is driven by V-belts running from flat-faced engine pulley to grooved sheave on generator shaft extension

Electrical Power Equipm ads

R H Wright, industrial engineering department, Westing house Electric & Mfg Co, describes the different classe of electrical power equipment, including power recovery for laboratory and production loading of aircraft engine and compares their first cost with propeller loadin



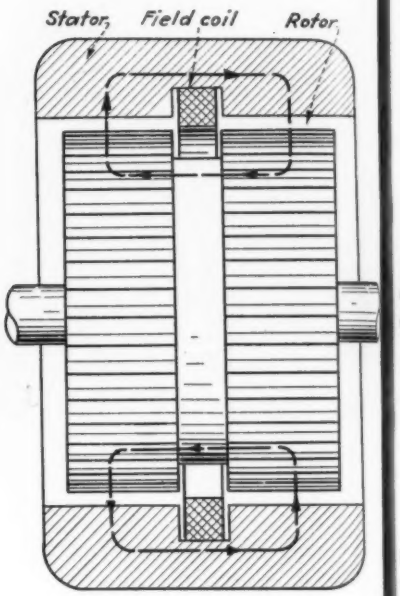


Fig. 1—A 150-hp 1200- to 540-rpm dc cradle-type dynamometer for laboratory-testing aircraft engines. Fig. 2—(right)—Cross-section through eddy-current-brake dynamometer; arrows show path of magnetic flux through the stator and rotor cores

► AT TAKE-OFF an airplane's engines must deliver maximum output because getting the plane off the ground takes greatest power. Accordingly, careful tests in laboratory and shops must demonstrate to a builder that an engine is fundamentally sound and will take full load as soon as it is mounted in a plane.

Performance of a complete multi-cylinder engine determines final design, but during preliminary development a number of full-sized single-cylinder models are built and laboratory tested to ascertain performance of various cylinder proportions, thus eliminating much multi-cylinder testing. The single-cylinder engines are run for long periods at heavy dynamometer loads.

After an engine's general design has been decided upon a full-size unit is built and its characteristics determined in the laboratory. It is loaded by a dynamometer, usually a general-purpose dc cradled electric unit, which is essentially a standard dc motor or generator supported in two anti-friction trunnion bearings so that its stator rotates within the limits of mechanical stops. Any torque exerted by or applied to the armature causes an equal torque reaction on the stator. A mechanical scale attached to the stator measures this reaction. Torque is read directly from the scale, and horsepower is calculated from simultaneous readings of torque and speed. Fig. 1 is a typical dc cradled dynamometer, built for capacities of ¾ to 1000 hp.

Eddy-Current Brake

The Dynamatic Corp eddy-current brake is a recent development in dynamometers. The machine serves the same purpose as a prony-friction or a hydraulic brake. As indicated by Fig. 2 and 3, an eddy-current brake has a cylindrical steel rotor with teeth on the rim. A field coil in a cradled steel stator surrounding the rotor sets up a magnetic flux across the air gap between stator and rotor cores. Rotation of the rotor in this flux produces eddy currents in the stator that load the power unit dri ing the brake rotor.

Water circulated through suitabl passages in the stator dissipates th heat generated by the eddy current Regulating the excitation adjusts th load and a scale attached to the stato measures the torque. Eddy-curren brakes provide in a small space a economical means for absorbing heav loads at high speeds, and are built fo absorption capacities from 30 to severa thousand horsepower.

Laboratory tests of large engines re quire a dynamometer with motor capac ity to crank and drive the engine whe idle so that its friction can be measure The dynamometer must also absorb ful engine output at any speed. Because th cost of a conventional dc dynamometer to perform both these functions is pro hibitive, a combination dynamometer made up of two units may be used. On unit, a cradled machine, has a capacity of 15 to 30% of the total absorption capacity of the combination dynamom

ads Aircraft Engines Under Test

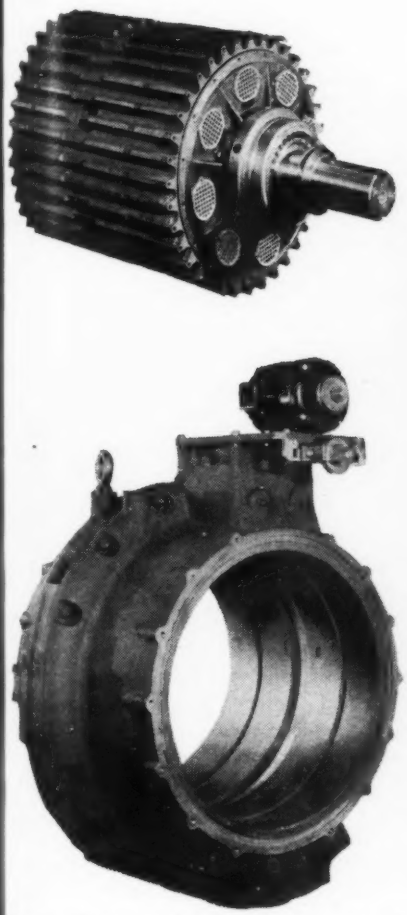


Fig. 3—Rotor with teeth and stator of a 2000-hp eddy-current dynamometer

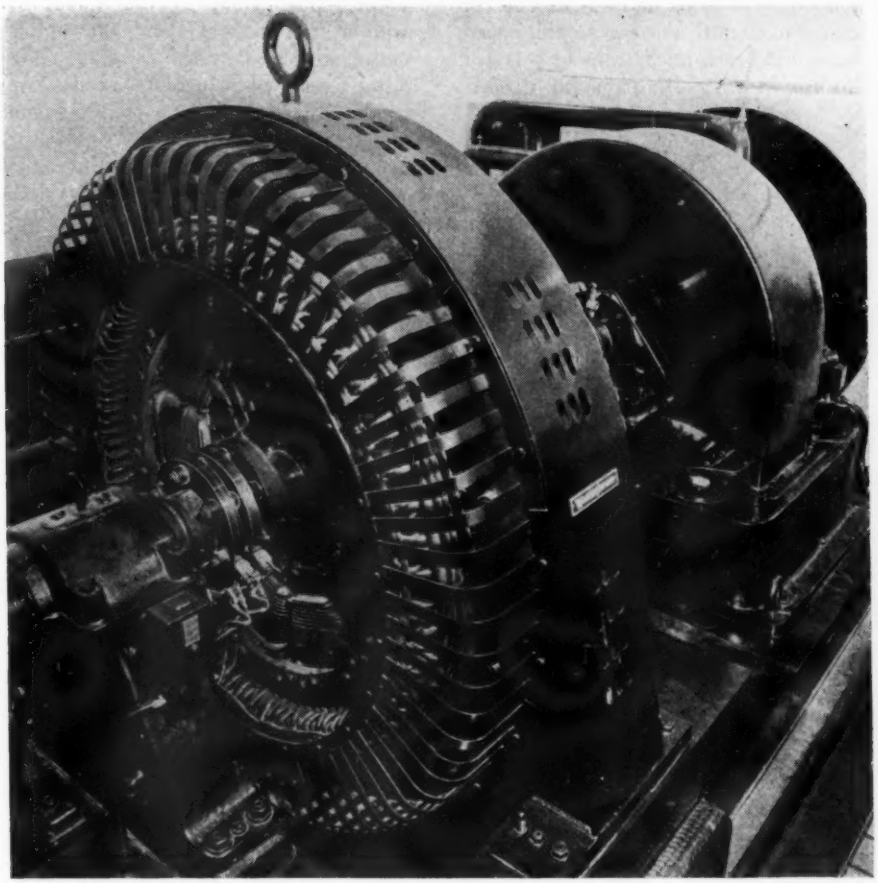


Fig. 4—Synchronous generator loads aircraft engines on production tests through variable-speed hydraulic coupling and feeds power into the plant system

eter and a cradled eddy-current brake. When the dynamometer absorbs load, the dc unit operates at full capacity and the eddy-current brake takes the rest.

Fig. 5 shows a typical combination dynamometer, consisting of a 3200-hp Mid-West Dynamatic eddy-current brake and an 800-hp Westinghouse dc dynamometer. Two anti-friction trunnion bearings independently support each unit, their shafts being connected by a flexible coupling.

The dc unit of a combination dynamometer usually connects electrically to a separate motor generator. A combination of variable-voltage and field control starts the unit and regulates its speed. Energy absorbed by the dc unit is converted to ac and returned to the power system.

Engines coming off the production line are given at least two test runs. During the first, or green run, the engine operates for several hours at varying speeds and loads. Then it is dismantled and its parts are inspected. After reassembly, another and final test run of several hours is made.

When production was at a moderate rate, propellers were convenient to load engines on production test. With enlarged engines and an enormous increase in production, consideration was given to electrical loading devices which could return considerable energy directly to the plant ac system. Engines can be loaded electrically for production tests in any one of several ways:

Electrical Loading

1. Couple the engine directly to an adjustable-speed dc generator to feed energy into a dc system. Hundreds of generators have been installed for this loading method, which has been used for many years to test automobile, truck and tractor engines. However, this system has not been used for aircraft with large high-speed engines because dc equipment cost becomes prohibitive.

2. Couple the engine directly to an eddy-current brake. With this loading method, power is not recovered, and cooling water to dissipate heat and a separate starting motor are required. Equipment, however, is simple and relatively inexpensive; load can be determined accurately and its control is positive and simple. For intermittent use and for installations having plenty of cooling water, the eddy-current brake loads aircraft and other large high-speed engines satisfactorily, and a considerable number have been installed for this purpose.

3. Equipment in the first high-capacity electric loading stands consisted of a synchronous generator connected to the engine through an American Blower Co. hydraulic coupling. The latter is similar to the ones in automobile transmissions but of a capacity to transmit several thousand horsepower; it has special control for regulating torque and slip. A damper winding on the rotor of the synchronous generator permits starting as a standard synchronous motor. The start is made with no oil

in the coupling. After the generator is running at full speed, oil is pumped into the coupling, and the generator, acting as a motor, cranks the engine and brings it up to firing speed. When the engine is firing and has been accelerated to slightly above generator speed, loads can be applied from zero to full throttle by controlling amount of oil in the coupling and regulating the throttle. Fig. 4 shows one of 16 loading equipments of this type, installed in an aircraft-engine plant.

4. Later installations use dynamatic magnetic eddy-current variable-speed couplings to connect the engines to the loading generators. Fig. 6 shows a schematic arrangement. An eddy-current magnetic coupling is similar to an eddy-current brake, except that both members of the former rotate and are enclosed in a case that permits cooling by direct water spray. Torque, transmitted by the coupling, and its slip are regulated by adjusting its excitation. Because of their speed-load characteristics, magnetic couplings can be used as brakes to load engines at speeds below generator synchronous speed. To do this, the generator rotor is locked with a friction brake and the engine output absorbed by the coupling operating as an eddy-current brake. You can combine a magnetic coupling and a generator for feedback loading or dynamometer tests. For the latter, the coupling is cradled and the movement of the generator rotor and associated coupling half is restrained by a standard dynamometer scale.

5. To avoid using cooling water to dissipate the heat from slip losses, one of the newer engine plants uses induction generators for production test loading. Electrical equipment for each test stand consists of a wound-rotor induction generator and an adjustable force-ventilated secondary resistor. With this equipment, the engine couples directly to the induction-generator rotor. Operation is the same as with a synchronous generator and hydraulic coupling, except that the slip losses are dissipated in the secondary resistor. The induction generator acts as a motor to crank the engine. Amount of energy returned to the plant power system depends on the relation of engine speed to generator synchronous speed. For engine speed about 3% above generator synchronous speed, engine output minus normal electrical losses is returned to the power system. When engine speed is twice generator synchronous speed, one-half engine output minus normal electrical losses returns to the power lines.

Induction Generators

Synchronous or induction generators have several advantages over propellers for loading aircraft engines. The test house structure can be smaller and less expensive because you do not have to provide for moving large volumes of air, nor reduce propeller noise. Engine operation can be checked more closely than with a propeller so that a slight deviation from standard performance is detected before shipment. A large amount of power that would be wasted is recovered for plant operation.

First cost of propeller-test and electric-test cells depends upon their capacity and the plant layout. For small engines, propeller-test cells generally show lowest first cost. For intermediate engine ratings, an electric brake provides the cheapest means for loading, but regenerative loading equipment may show a good return on the additional cost. For larger engines, test cells with electric-loading equipment have the lowest first cost, and energy value recovered is a net gain.

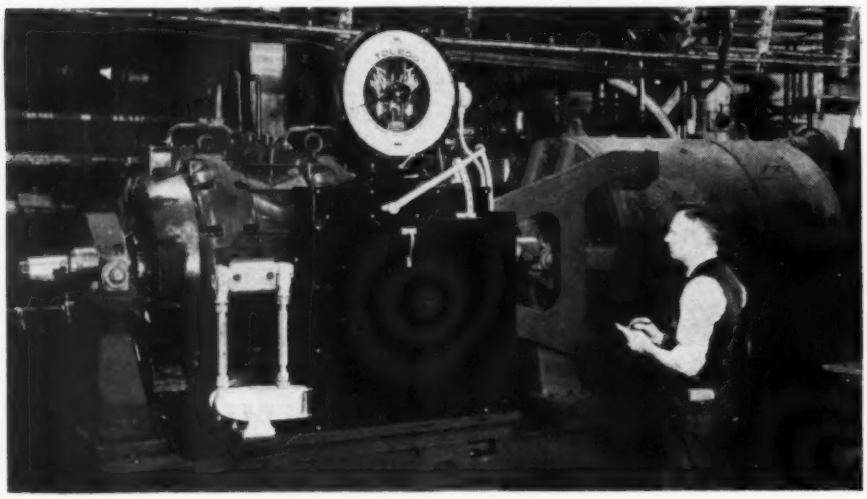


Fig. 5—A 4000-hp 700- to 2000-rpm combination dynamometer, consisting of a 3200-hp eddy-current brake and an 800-hp dc dynamometer, supported by anti-friction bearings and used for complete laboratory-load testing of large aircraft engines

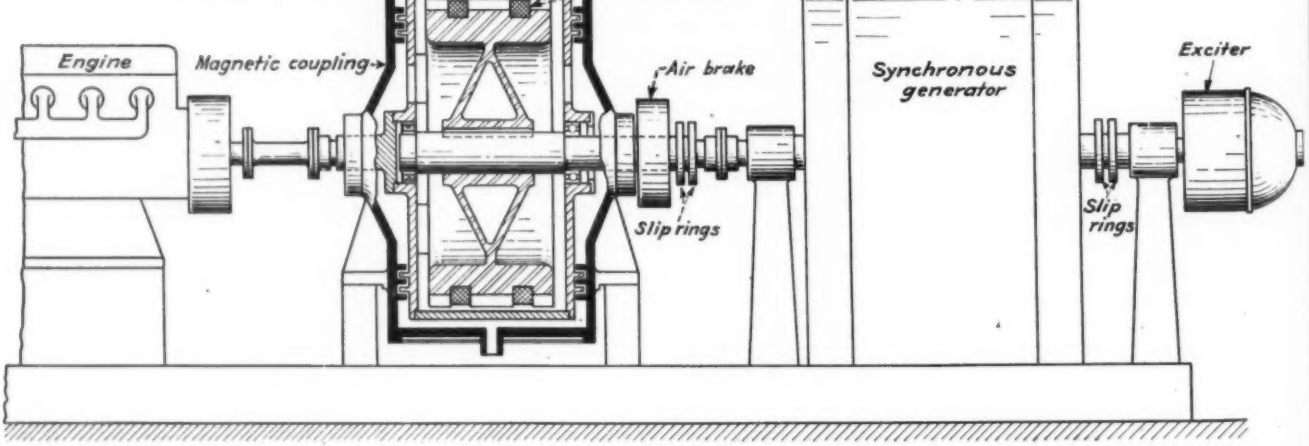
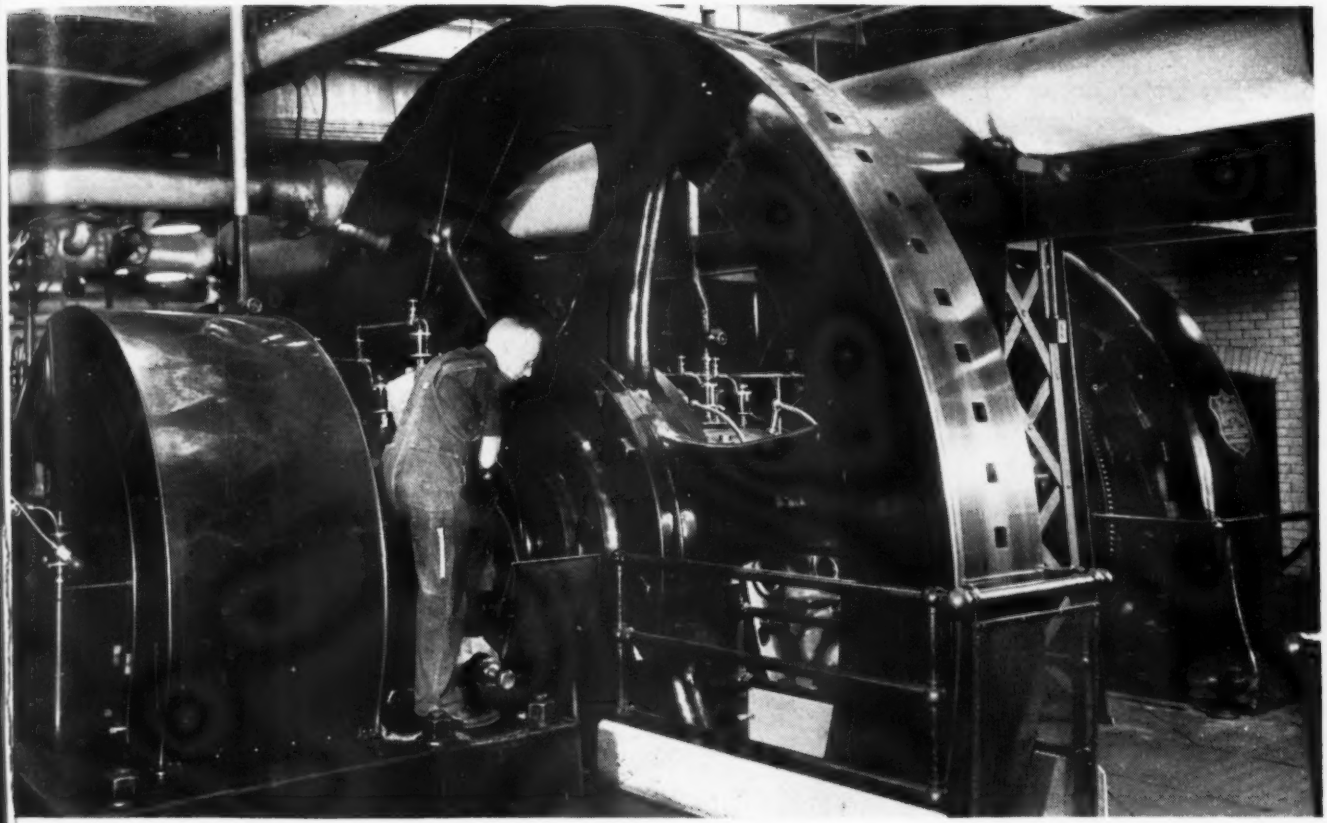


Fig. 6—Eddy-current magnetic coupling connects synchronous generator to aircraft engine for production testing and feeding power into the plant system. Load, transmitted by the coupling, and its slip are regulated by adjusting its excitation

STEAM ENGINES GOING STRONG AFTER 41 YEARS OF SERVICE



In 1902, about the time that steam-engine design reached its peak, the power plant in the Mutual Life Insurance building at 34 Nassau St, New York City, began operation with four of the largest non-condensing engines ever installed in a public building.

It was about this time that great steam engines, totaling 25 or 30 units, were installed in New York's Waterside, 74th and 59th St power-generating stations. Over 40 ft high and weighing with their alternators nearly a million pounds, these engines were good for about 10,000 hp each, had a 5-ft stroke and operated at 75 rpm. It was in 1902, also, that the success of America's first 2500-hp condensing steam-turbine-driven alternator, in the Pearl St station of the Hartford Electric Light Co, Hartford, Conn., spelled the beginning of the end for large condensing steam engines.

The four Watts Campbell non-condensing engines in the Mutual Life building are horizontal single-cylinder double-eccentric releasing-valve-gear corliss units with an overhung crank-disk. With a 4-ft stroke and operating at 75 rpm, they have a piston speed of 600 ft per min. Other dimensions are: piston diameter 28 in., crosshead 38 in. deep with a 6.25-in. pin, connecting rod length 12 ft, crankpin diameter 7.5 in. Using 150-psi saturated steam, these engines develop about 700 hp.

The 16-in. crankshaft, with the flywheel shown in the photo, runs in two bearings, with a coupling between it and the generator-armature shaft, which is also supported in two bearings. Weight of the rotating element, including the generator armature, is about 100 tons, one-half of which is in the flywheel.

The 16-ft flywheel on each engine has a rim 20 in. square in cross-section, is cast in six parts, each of which consists of one-sixth of the rim and one spoke, machined to assemble with a close fit. Spearhead shrink keys lock the rim sections together. Three close-fitting bolts lock the end of each spoke into a 2-part cast-steel hub. After being assembled, the flywheel was rotated, turned and polished to a smooth finish, and then japanned so that practically all signs of joints and keys disappeared. The photo shows how thorough a finishing job it was, for the flywheel is as shiny as when it was new, 41 years ago.

Steam was originally supplied by eight inclined watertube hand-fired boilers, operated at 150 psi saturated. They were shut down in 1916 and steam was purchased for the engines and other plant equipment. The boilers now operate in winter only, to help carry the peak load on the steam company's system. Located four stories below ground level, the boilers connect to the steam engines in the first basement by a 20-in. header approximately 150 ft long.

Now turn to pages 98, 99 and 102, where we describe other features of this 41-year-old-plant, which is directly in charge of Thomas Wood, chief engineer, and his assistant, Dan Ryan. POWER is indebted to Robert B Kay, supervisor of maintenance, for permission to publish this article.

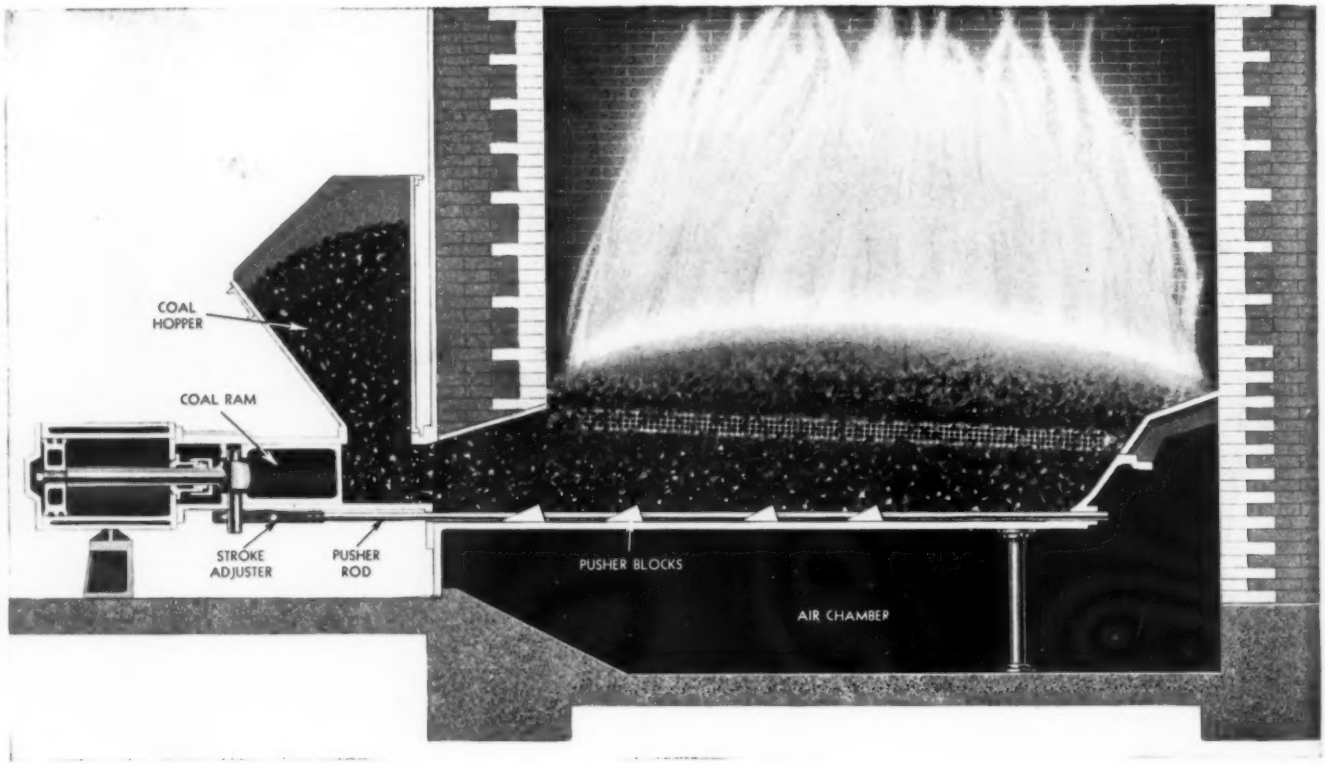
CONTINUED ON PAGE 98

CONVERSION from Oil to Coal when RILEY-JONES

Many of the companies which have changed from oil to Riley-Jones Stoker coal firing have been agreeably surprised to find that Riley-Jones Stoker firing has proven not only more profitable but also more satisfactory. Appreciable savings have been made in fuel bills and in many cases greater amounts of steam have been generated.

All facts and figures seem to indicate that the conversion from oil to coal firing is not merely a temporary requirement, but that even after the war, coal will have to be burned rather than oil, because of economical reasons. It will be cheaper to generate steam by coal firing than by oil firing.

It behooves everyone converting from oil to coal to consider the conversion as permanent. It is only sound business, therefore, to purchase stoker equipment which, because of its rugged construction, will give satisfactory performance and low maintenance for years to come. The Riley-Jones Stoker is such a stoker.



LONGITUDINAL SECTION OF RILEY-JONES STOKER

Brief Description of How Riley-Jones Stokers Operate—Coal is fed in furnace by coal ram and is evenly distributed by pusher blocks. Ignition takes place immediately, above the retort. As green coal nears this zone of heat, volatile gases are liberated and are burned as they pass through the incandescent fuel bed. Air is blown through a multiplicity of small air openings or tuyeres at top of retort. The coal, after passing out of the retort and over tuyere blocks is turned to coke, the gases having been driven off. To properly burn coke only a small quantity of air is required. The coke passes side-

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

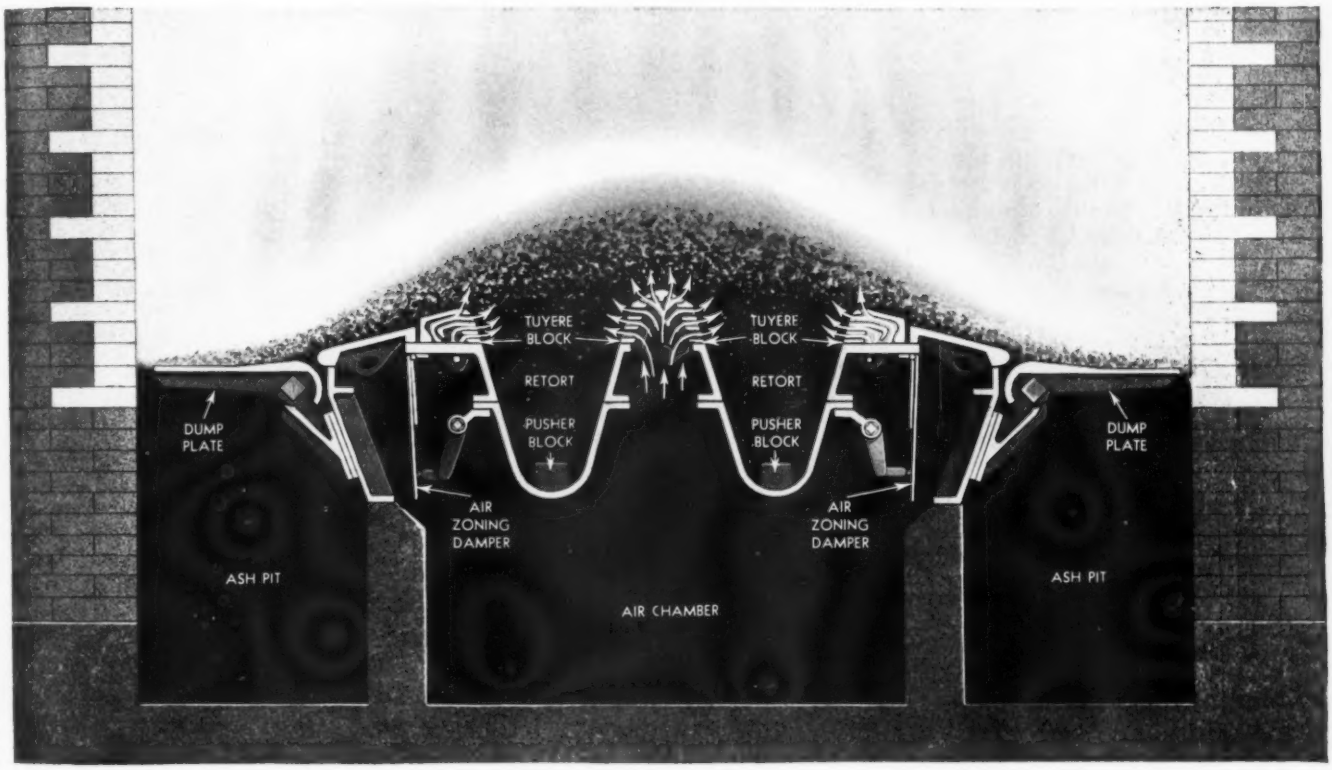
Repeatedly Proves Profitable STOKERS are used

Experiences of a Few Users

"We would rather fire this boiler with Riley-Jones Stokers and coal than with oil. We can maintain our steam pressure easier and are saving money by burning coal."

"While sustaining 175% rating, we bring up the pressure from 150 to 175 pounds in five minutes without smoke. We never could do this with oil. Expect our refractory troubles to be much less."

"From eight to eleven o'clock every morning, except Saturdays, we take out better than 1200 H.P. from our 597 H. P. boiler. With oil we never could carry the full plant load, but with coal and Riley-Jones Stokers, this one boiler can handle the whole load."



CROSS-SECTIONAL VIEW OF RILEY-JONES TWIN-RETORT STOKER

ways over the overfeed grates, where the carbon is burned out of the coke, onto the dump plates where only ash remains. At infrequent intervals, normally not more than two or three times in twenty-four hours, the dump plates are lowered and ash is dumped into the ash pits where the ashes are quenched and later removed.

Riley-Jones Stokers are adapted to boilers from 50 to 600 H.P. They are manufactured as single retort, twin retort or duplex types with steam, hydraulic or mechanical drive.

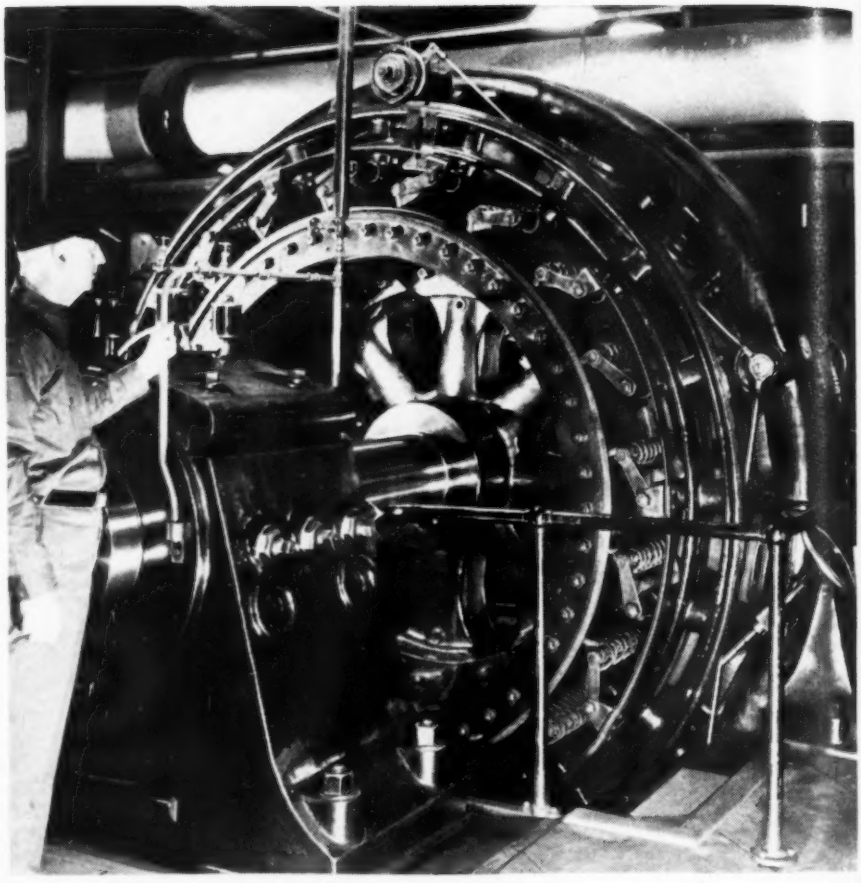
A Riley engineer will gladly visit your plant to discuss the application of Riley-Jones Stokers without obligating you in any way.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

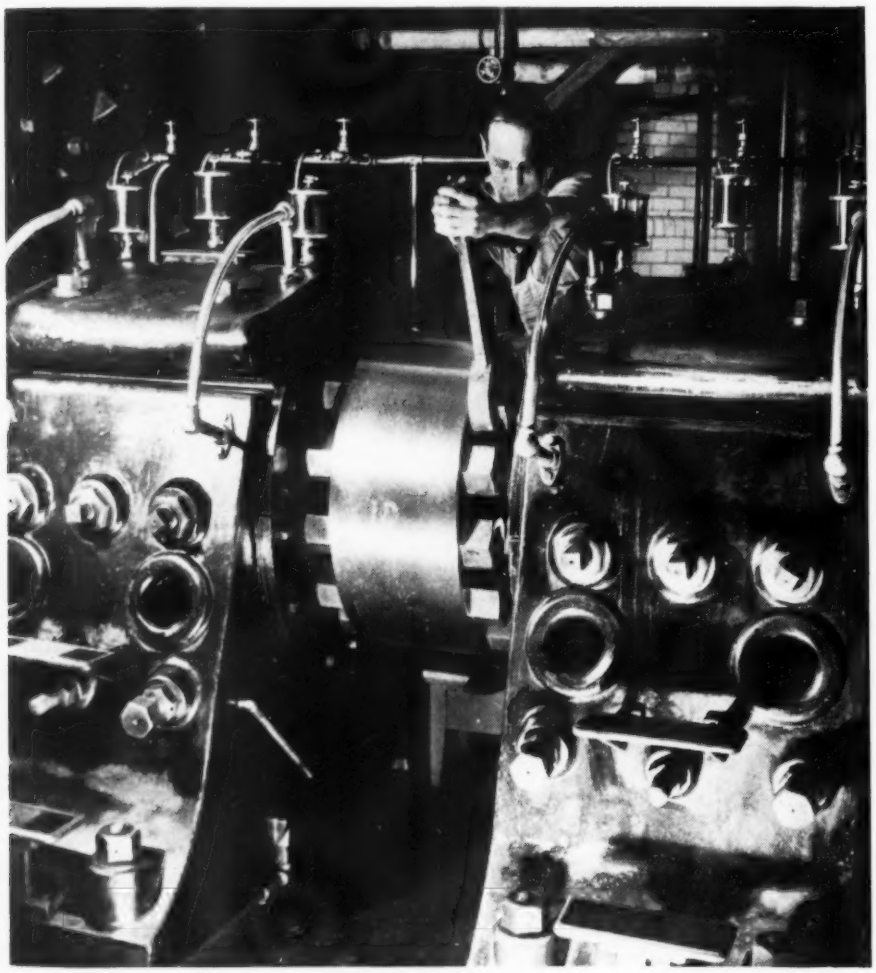
COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATERCOOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

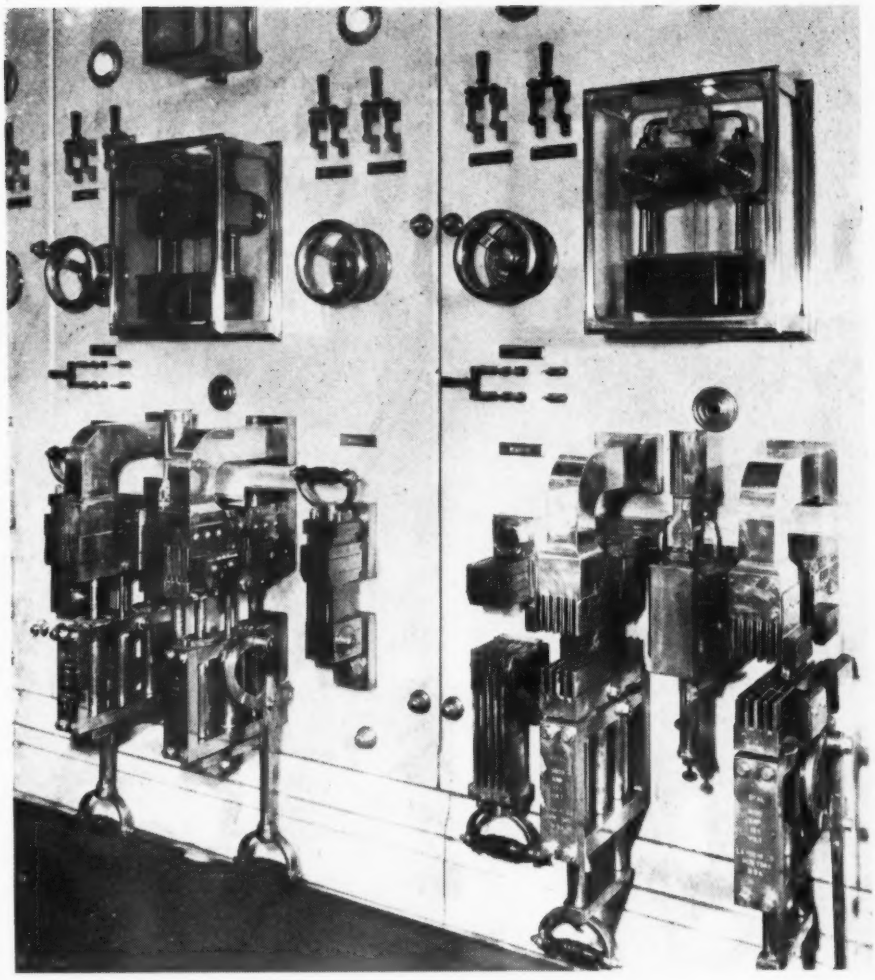
CONTINUED FROM PAGE 95



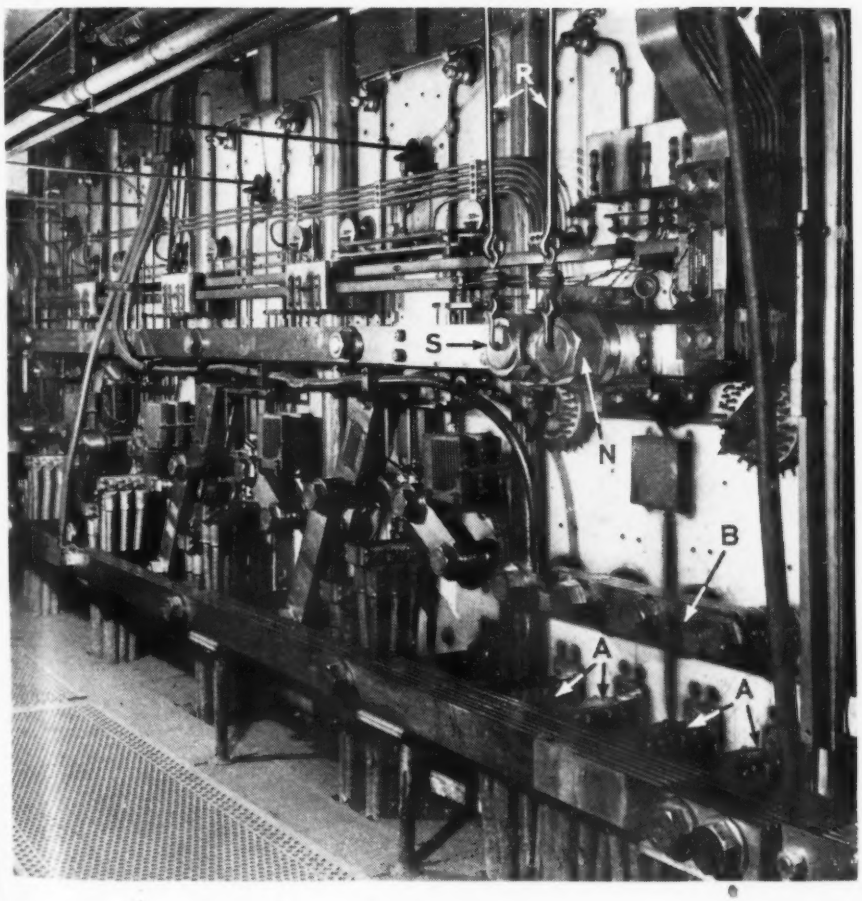
A 3000-amp 115-v 2-wire dc Bullock generator, good for 50% overload, 4500 amp continuously, couples directly to each of the four engines. After 41 years, each generator has its original commutator, which is 7.5 ft in diameter, with a 16-in. face. Each generator has 20 poles and, therefore 20 sets of 8 brushes, or a total of 160. Armature core and commutator are supported on two spiders, the hubs of which key to a 14.5-in. shaft. Outside diameter of field-pole frames is 12 ft. An interesting feature is the brush yoke. It is supported on a stub shaft at top and bottom of the field-pole frame, and connects to an oscillating mechanism driven by a flat belt from the armature shaft. This moves the brushes back and forth across the commutator to insure equal distribution of wear on its face.



The 16-in. crankshaft and the generator shaft, as previously mentioned, are each supported in two bearings, and connected by a solid coupling 30 in. in diameter with a 16-in. face, the halves of which are held together by twelve 2.75-in. bolts. The coupling, forged as part of the two sections of the shaft, makes it as rigid as if its 25-ft length were one piece, and it must be as accurately aligned as if it were. The pillow-block bearing pedestals support 4-section babbitt-lined cast-iron bearings whose bottom and side sections are wedge-adjusted by three bolts. Bottom section cannot be rolled out as with many bearings, and is removed only by jacking up the shaft enough to let the bottom quarter slide out horizontally. Three drop-feed oilers lubricate each of the four bearings. Other important engine bearings are also lubricated by drop-feed oilers, all of which are supplied from a gravity tank into which oil is pumped after passing through the bearings.



The switchboard is the very essence of switchboard elegance. White marble panels, 8 ft high by 4 ft wide, mounting heavy, shining copper switches, circuit breakers and other parts, make it a work of art to stir the soul of a maharaja of India. The photo shows the lower part of two of the four generator panels, with the circuit breakers at the bottom. A single-pole switch for the postive lead from the generator is on one side of a generator breaker, and the negative switch is on the other side. Equalizer switches are at bottom of a totalizing panel not shown. The breaker's moving contacts close vertically, singly by a cam, operated by a lever. Once the breaker is closed, its two poles can be tripped out simultaneously by a trip coil, in case of overload, or by hand. Left-hand breaker is closed in the photo, and right-hand open. Each generator has a watthour meter, a voltmeter, an indicating ammeter and a recording ammeter, the latter imported from France.



Front and back of switchboard are a vertible copper mine; photo shows back of board. Between generator and distribution panels, the busbars have sufficient capacity to carry about 15,000 amp. In this section, each of the two busbars consists of eight ½-in. thick by 5-in. deep copper bars. Four equalizer connections from the generators connect to the bottom studs *A* of the equalizer switches whose top studs connect directly to a short bus, *B*. Each positive, negative and equalizer lead from the generators to their switches consists of six 500,000-cm rubber-and-braid insulated cables. An interesting feature is the connection of the totalizing watthour meter into the positive bus. Meter studs, *S*, each 4.5 in. in diameter, extend out 21 in. from back of the board. The busbar connects to these studs with clamp-on fittings 15 in. long. Heavy nuts, *N*, help to make contact between watthour-meter studs and busbar connections. Studs, *S*, are supported from overhead by rods, *R*, to take weight off the watthour meter.

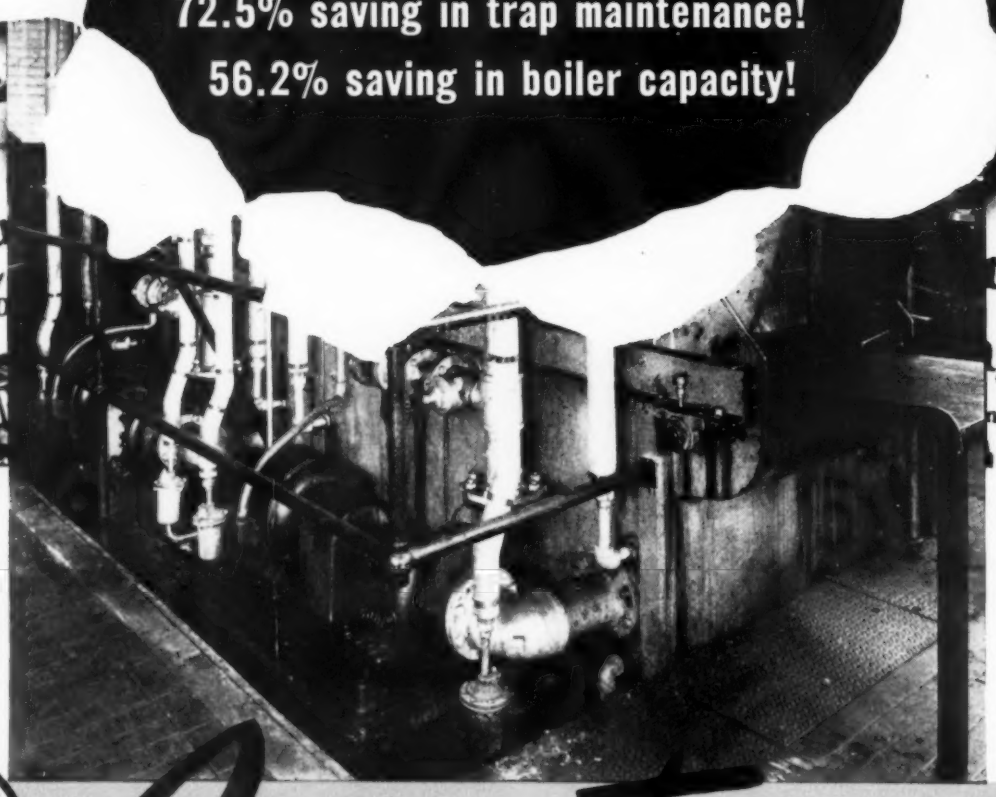
CONTINUED ON PAGE 102

Save 19 Days Maintenance Time Per Mon

SAVINGS

Of reports turned in over the past 13 years dealing with savings secured by Armstrong trapping, those that give figures show the following average or typical percentages:

38.5% saving in fuel!
40.0% saving in heating time!
72.5% saving in trap maintenance!
56.2% saving in boiler capacity!



Right—Armstrong steam traps draining metal washing machine in large industrial plant, which has installed 674 Armstrong traps in the past 18 years.

ARMSTRONG "INVERTED BUCKET" STEAM TRAP

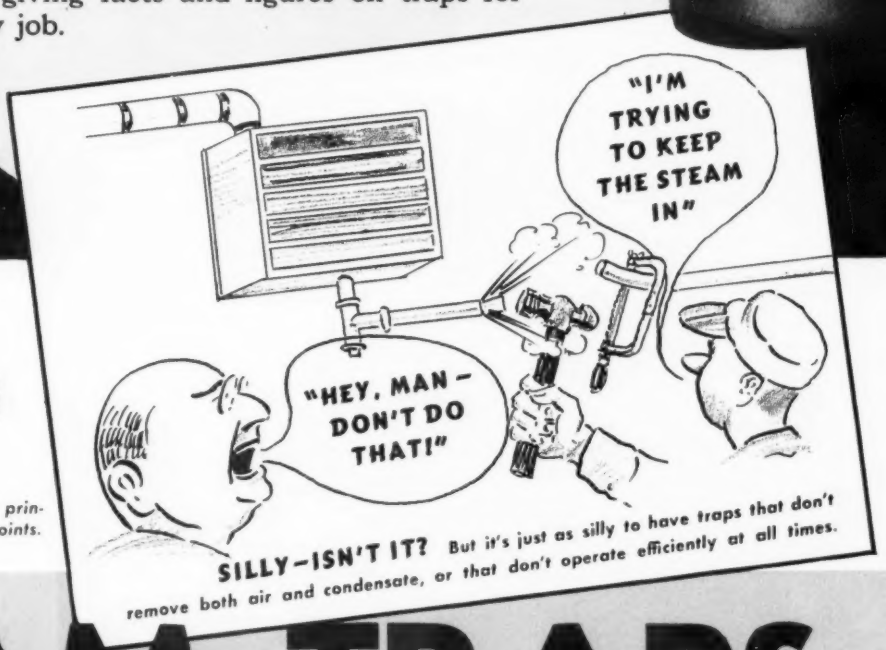
Armstrong

that helps WAR PRODUCTION

CONSIDERING the small amount of metal and the small cost involved in Armstrong steam traps the savings they offer in fuel, time, manpower, metal and money are impressive indeed.

Some typical examples: A pumping plant saved $2,600 a year in steam cost by installing Armstrong traps. A packing company cut cooking time on kettles 57%. A laundry spent only $3.00 for maintaining 32 Armstrong traps in 6 years. A canning plant found it possible to get along without a new boiler after changing over to Armstrong traps.

These benefits didn't just happen. They were built into Armstrong Traps in the form of big hot condensate capacity, automatic air handling ability, long life parts and trouble free design. No other trap offers the free floating valve, only two moving parts, self-scrubbing action, and complete freedom from sticking or binding. Write today for the Armstrong Trap Book giving facts and figures on traps for every job.



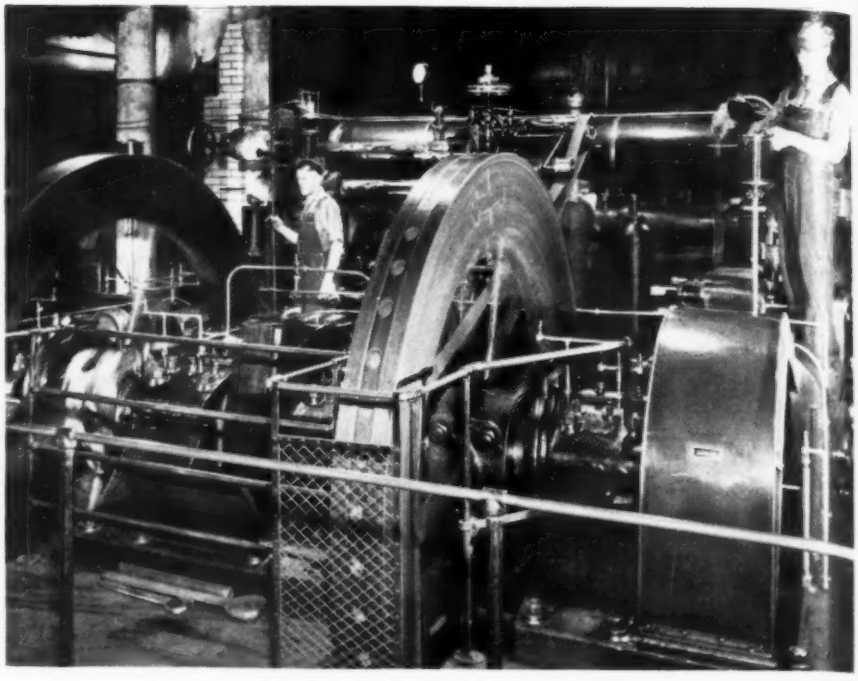
SILLY—ISN'T IT? But it's just as silly to have traps that don't remove both air and condensate, or that don't operate efficiently at all times.

ARMSTRONG MACHINE WORKS
812 Maple Street
Three Rivers, Michigan

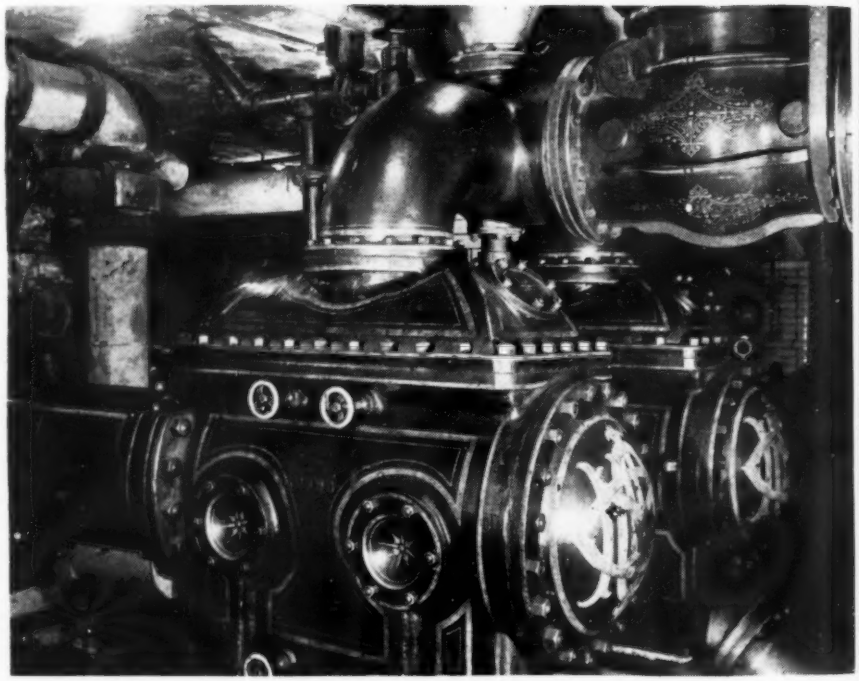
Experienced sales and service engineers in all principal cities. Traps carried in stock at 144 points.

STEAM TRAPS

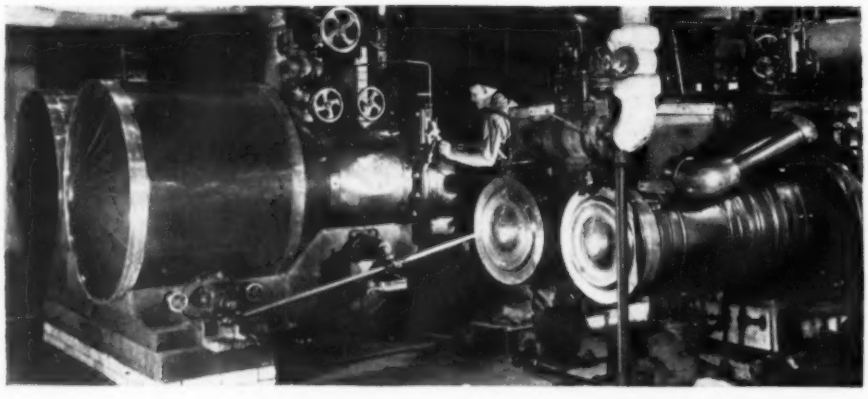
CONTINUED FROM PAGE 99



Crankshaft end of the large Laidlaw-Dunn-Gordon steam-engine-driven pump that supplies pressure water at 125 psi to ten hydraulic elevators. The cross-compound engine has three cylinders —a high-pressure one between two low-pressures. Engine operation is made stable by two heavy flywheels on the crankshaft, one between each low-pressure cylinder crank and the high-pressure. The steam cylinders have non-releasing corliss valve gear and connect to a single-acting triplex outside-packed plunger pump. Each pump cylinder has a 12-in. plunger with a 24-in. stroke, and 114 valves. Pump is rated 2200 gpm at 100 engine rpm.



Here, in the water end of the large standby reciprocating pump mentioned below, we see examples of power-plant art in the gay nineties. Evidently the gaiety of that period was not all in the women's dress. The object in the upper right-hand corner, decorated with a filigree design, is the check valve in the discharge line. Covers over suction and discharge valves are beautifully decorated with 8-pointed stars. On the heads of both cylinders, the owner's monogram is emblazoned, and the plant's boiler-feed pumps have this monogram on the air-cushion chambers. The air chamber on the discharge of the pump in the photo is said to be coated with gold leaf. Gold or bronze. it must be good stuff to have withstood the ravages of 41 years.



Steam end of a large Worthington duplex direct-acting piston reciprocating tandem-compound steam pump that serves as a standby unit for the hydraulic elevators. Each pump cylinder has a high- and low-pressure steam cylinder in tandem, the high-pressure cylinder being next to the pump. On the right is the steam end of the direct-acting duplex steam pump used for night-elevator service. This unit is also tandem compound on its steam end, the low-pressure cylinders being next to the water end of the pump.

Aviation—A Progress Report

The Lessons of War Become the Key to a Richer Peace

TUNISIA, PANTELLERIA, SICILY—stepping stones to momentous events! But that is not all. For they spell out across the blue waters of the Mediterranean a pattern of invasion that has progressed far since last summer's first major Commando operation against the French coast.

From Dieppe, you remember, too many of the raiders never got back. But in Tunisia, and on through Sicily, the Allied might plowed inexorably forward, winning objective after objective at a surprisingly low cost in casualties. Air supremacy over the battlefield? Yes. But we have learned, too, how to save lives and shorten the war by strategic air bombardment as a prelude to invasion.

Thus the bombardment plane—rarely seen by the doughboys on the fighting fronts—is destined to save their lives by hundreds of thousands in the decisive attacks that are to come. This fact is confirmed by the cold calculations of the responsible strategists. It will give renewed courage and confidence to every member of the armed forces and of the home fronts throughout the United Nations.

For instance: thorough strategic bombardment of an objective reduces by nearly fifty per cent the surface forces required for invasion. Anticipated losses are reduced from more than fifty per cent of the original ground force to about twenty per cent. Precision bombardment—as used on railroad objectives in Rome—reduces this percentage of loss still further when it is followed by offensive action on the ground.

This is the fifteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

The inference is clear. Effective prosecution of the war will require smaller ground combat forces and much larger air forces than some of our strategists once thought.

Our most urgent need, then, is for ever-mounting fleets of aircraft. And, fortunately, this is just what we are getting. The American aircraft industry now is producing as many airplanes as all the rest of the world combined. In 1938 we made 100 planes a month. Now we make three times that many in a single working day. By the end of 1943, our production rate will be about 10,000 a month.

But at this stage of the war, types of planes are more important than mere numbers. In the early months the program was heavy, and properly so, with single-engine trainers. Then, as training planes accumulated, the emphasis shifted to heavier types. Now we are turning out multi-engined bombers at a rate that is the envy of the entire world. Some months ago the President revealed that we were manufacturing 500 long-range bombers every month. The figure was conservative even then. And soon we shall be producing planes of this one type at a rate adequate to replace the normal losses of a fleet of at least 1000 American heavy bombers operating as continuously as the weather will permit.

A glimpse of the poundage production may help us still further to evaluate the miraculous achievements of the aviation industry as a whole. It was 89,000,000 in 1941 . . . 291,000,000 in 1942 . . . 911,000,000 in 1943 . . . and 1,417,000,000 in 1944

— if we need it. There you have the magnificent record of the American aircraft manufacturing industry — a monument to the cooperation of industry, labor, government, and to all-out teamwork between the aviation industry and those other industries which have converted their facilities to the manufacture of airplanes.

What of our enemies and our Allies?

German production probably has flattened out at 2500 a month — with downward revision in immediate prospect. Japan may be able to produce as many as 1000 planes a month — until we get our new long-range super-bombers in sufficient numbers to whittle down that figure. Italy may be able to turn out her 500 a month — for a little longer. At best the maximum Axis monthly total is 4000.

Add to our monthly score of nearly 8000, a total of approximately 4000 for Britain, Canada and Russia, and the United Nations score comes to 12,000 monthly. There we have a three to one advantage for our side. And between our own rising production and the brilliant operations of our bomber commands we should soon boost the ratio well above that figure. Therein lies the certainty of continued and growing air superiority over all the far-flung battlefields.

The critics of American airplane quality have been silenced ever since the ratio of enemy combat losses to our own on bombardment missions surpassed four to one. In the Pacific where our heavily armed and armored planes are knocking off the desperately stripped racing craft of the Nipponese, enemy losses often run as high as eight to one or more. In the Mediterranean theater, where the Italians were abandoned by their Allies, the story is much the same. Only in the well-defended homeland of the Nazis do we sometimes drop below the average, but even in those rare instances the ratio is still well in our favor and the effectiveness of our bombardment is adding constantly to our margin.

* * *

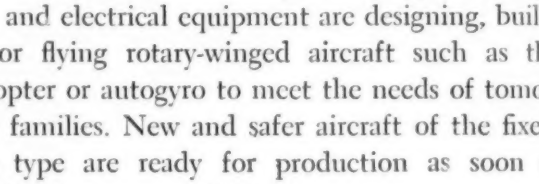
Behind the production lines the battle of research and design still rages. In many a laboratory night-shift, on many a secret test field, new and terrible surprises for the enemy are in the making. Super-bombers, destined for Tokyo, have long since passed out of the design stage and the Japanese may learn about them almost any day. New discoveries, designed to sow swift and silent devastation, are farther along than our enemies believe. No longer will fog or storm or night be permitted to fight on the side of our foes.

The men of science who are toiling to broaden the horizon of our knowledge stand today on the threshold of discoveries that have been sought for centuries. New reservoirs of power may soon exert a profound influence in many fields of technology and through them on our way of life.

Once the war is won these new discoveries will be translated into better living. No longer will countless thousands spend their lives within their own communities or countries. New efficiencies in transportation will bring world travel within the reach of many who once had to stay at home. New family vehicles will navigate the skyways as easily and safely as the highways. Already more than a dozen manufacturers of airplanes, ships, automobiles, and electrical equipment are designing, building, or flying rotary-winged aircraft such as the helicopter or autogyro to meet the needs of tomorrow's families. New and safer aircraft of the fixed-wing type are ready for production as soon as materials become available.

The quality that now makes each of our war planes worth so many of those built by our enemies will be translated into the sturdy reliability demanded by peacetime operation. The devices that seek out and find our enemies behind the veil of fog or darkness will, after the war, reduce weather hazards to the point where they will be no greater in the air than on the ground.

Science and industry will continue to do their jobs and do them well. But if the world is to be made a better place for men to live in, statesmanship must not fail to do its part.



President, McGraw-Hill Publishing Company, Inc.

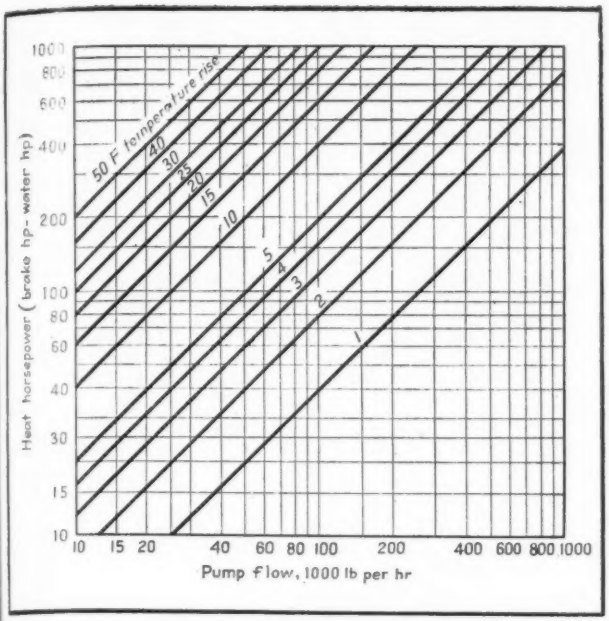


Fig. 1—Typical performance curve for high-pressure centrifugal pump. By using chart on page 138, rise can be calculated

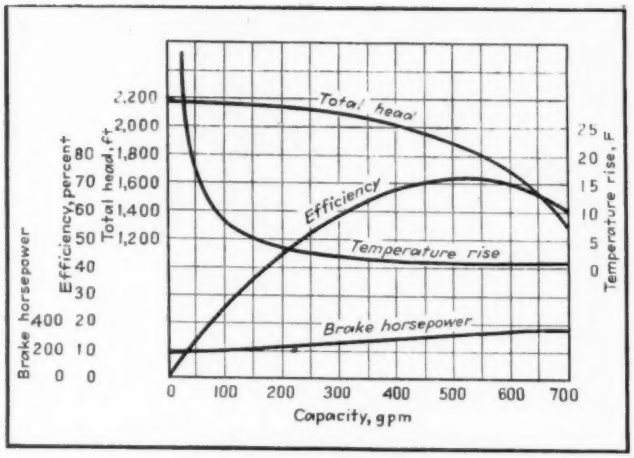


Fig. 2—Chart of temperature rise in terms of heat horsepower and total pump flow for temperature rise by older method

Temperature Rise in Boiler-Feed Pumps

With the Data Sheet chart on page 138 and a performance curve for your pump you can quickly see if the temperature rise in a centrifugal boiler-feed pump is too high for safety

By IGOR KARASSIK
and ROY CARTER
Worthington Pump & Mach Corp

▶ FEEDWATER DELIVERED by a centrifugal boiler-feed pump operating at low flow is subject to appreciable temperature rise. Formulas and charts for calculating the rise, already published*, involve a certain amount of preliminary calculation not necessary if a somewhat different approach is used.

The difference between brake hp consumed by the pump and the water hp developed represents power loss within the pump itself all of which is transformed into heat. While some of the loss actually goes into bearing friction and radiation, it is accurate enough for all practical purposes to assume that all the heat is absorbed by the feedwater.

Actual temperature rise is directly determined by multiplying hp loss by 2545 Btu per hphr and dividing by feedwater flow in lb per hr. Fig. 2 shows a graphical representation of this formula.

However, most pump performance curves like Fig. 1 show head in feet against flow in gpm. It is necessary to change gpm to lb per hr by multiplying by 500 and the specific gravity at some given temperature. If feed temperature varies over the operating range, as is frequently the case, the conversion to lb per hr becomes fairly tedious. In addition, calculation of water hp must be carried out at several flows and subtracted from corresponding brake hp inputs to determine heat loss.

The temperature rise can also be expressed:

$$\text{Rise} = \frac{\text{Head in feet}}{778}\left(\frac{1}{e} - 1\right)$$

where e is the pump efficiency. Since any pump characteristic curve shows total head and pump efficiency against flow, temperature rise at that flow can be easily calculated without reference to specific gravity tables.

Data Sheet No. 133 on page 138 presents a graphical chart of this formula. From it the temperature rise can be obtained directly and, in addition, the *minimum permissible flow*, once maximum allowable temperature rise has been selected.

Maximum temperature rise that can be allowed for a given pump cannot be determined exactly as it depends on a great number of variables such as available net positive suction head, first-stage impeller design and the operating temperature. It is general practice, however, to set a limit of 15 F.

The chart can be used to plot a temperature-rise curve directly on the head-capacity curve as in Fig. 1, which represents the performance characteristic of a boiler-feed pump designed for 550 gpm of 250-F feedwater and a total head of 1800 ft.

If the feed pump has a balancing device with the leakoff returned to the heater at the suction of the feedpump, neither of the foregoing methods give an accurate answer. This discrepancy results from the fact that the apparent capacity of the pump as measured at the pump discharge is lower than the actual flow handled (by the amount of leakoff). However, the rise in a pump fitted with a balancing device can be calculated if the pump efficiency is assumed to be increased by the ratio:

$$\frac{Q + Q_d}{Q}$$

where Q = Flow at discharge of pump, lb per hr

Q_d = Quantity of leakoff, lb per hr

After multiplying the efficiency as obtained from the pump characteristic curve by this ratio, use the chart as before.

* "Thermodynamics of Boiler Feeding" by I J Karassik, published by Hydraulic Institute, 1941; also "High-Pressure Boiler-Feed Pumps", Part II, by I J Karassik, POWER, May, 1941.

Are Protective Devices Making Your Air Compressor Foolproof?

Mechanical watchdogs prevent damage or detect trouble so quickly that resulting harm is minimized. H H Miller, Worthington Pump & Machinery Corp, tells how filters, drains, valves and gages can check faulty operation

▶ MAKE YOUR COMPRESSOR INSTALLATION complete by providing protective devices and indicating or recording instruments. They are especially needed on a compressor in a remote spot without regular attendants, where well-chosen appliances working together can provide trouble-free operation. Local conditions may justify using all of the following devices.

Filters. On suction lines, filters prevent dust and dirt from the atmosphere getting into the machine. On gas compressors, filters or scrubbers eliminate possibility of sand and grit being carried into the compressor and damaging valves, piston rings, piston-rod packing and cylinder walls. Obviously, since it is vital to filter air or gas passing into the machine, it is equally important to clean all welding shot, scale and other foreign matter from a new suction line; otherwise, such dirt would be a source of trouble shortly after starting up. Far too many compressors are damaged during the first weeks of operation; even tools and overalls sometimes find their way inside machines.

Good commercial intake filters have become standardized and are relatively so inexpensive that earlier homemade ones of questionable efficiency can no longer be justified. Air filters are not

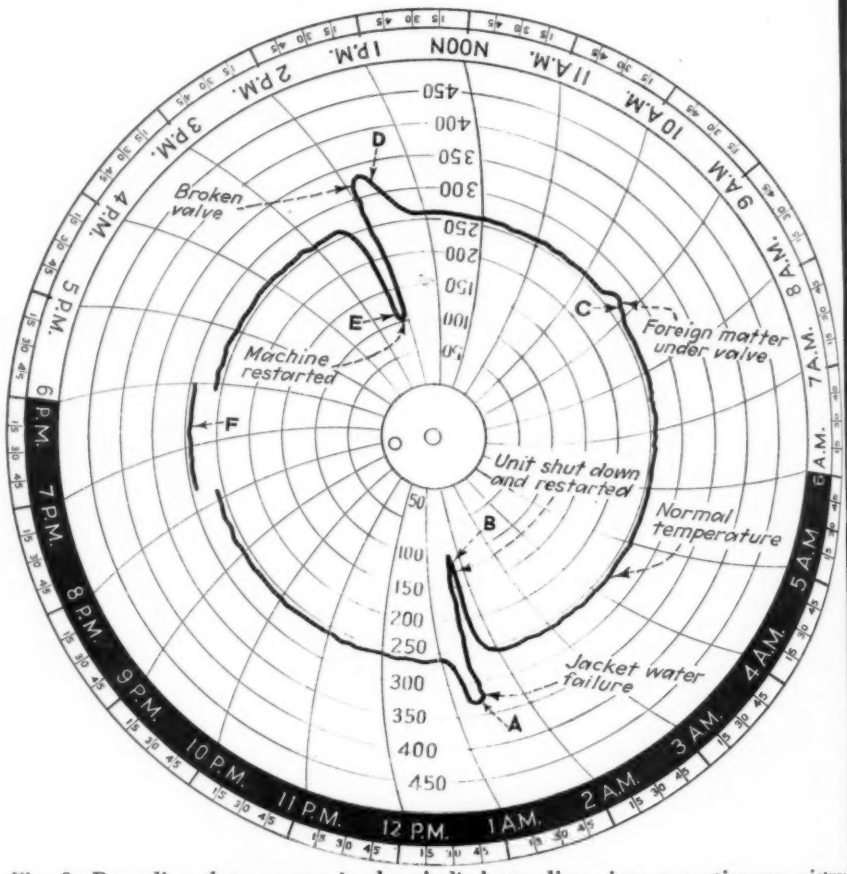


Fig. 2—Recording thermometer in the air-discharge line gives a continuous picture of machine operation. Attendant discovers high temperatures before damage occurs

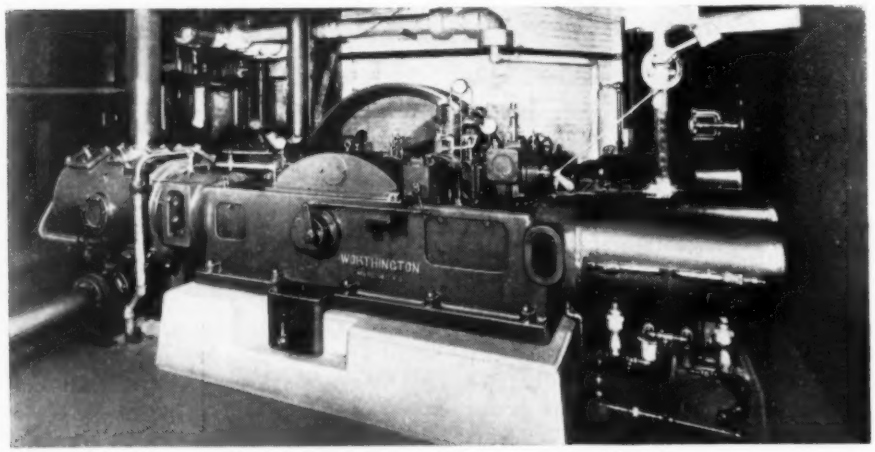


Fig. 1—Weighted butterfly valve in steam line is tripped by crosshead over-travel, caused by overspeeding. Cylinder relief valves discharge condensate when starting

included as standard equipment on new compressors.

Discharge safety valve. Safety valves must protect compressors on the discharge line and also on intercoolers. Every air compressor should have an air receiver near it on the discharge line. All standard air receivers carry safety valves. However, if you follow the usual procedure of installing a stop valve in the discharge line between compressor and receiver, you should also install a safety valve on the line between compressor and stop valve. This applies also to gas compressors, which seldom have receivers but do have stop valves in the line. This safety valve is part of the compressor piping

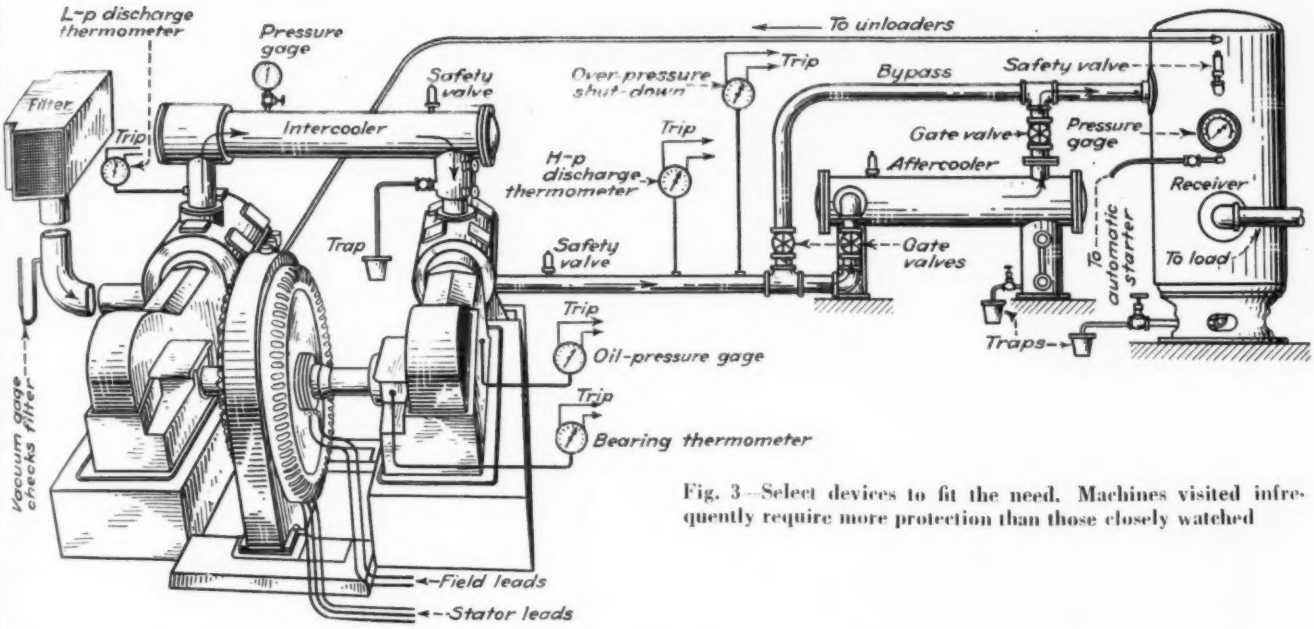


Fig. 3—Select devices to fit the need. Machines visited infrequently require more protection than those closely watched

and, as such, is not supplied with standard compressor equipment.

It is common practice to install bypass connections to the atmosphere on compressors, to permit starting the unit with pressure in the discharge line. In such cases, install safety valves ahead of the line stop valve to protect the compressor against starting with all valves in the line closed. Similarly, a bypass is frequently installed on the discharge around an aftercooler to permit dismantling it for cleaning or repair without shutting down the compressor. Install a safety valve on the compressor side of the bypass to avoid damage in case valves are not properly opened.

Steam-Cylinder Protection

Relief valves, of course, are required on steam-driven compressors at both ends of the steam cylinders, as protection against gradual condensation accumulation. These relief valves, however, are not large enough to take care of water slugs, such as occur from poorly designed steam lines having low spots without proper condensate drains.

A steam-driven compressor having compound cylinders needs a safety valve on the steam receiver, set for a pressure slightly greater than normal. Any valve popping gives ample warning of steam cutoff misadjustment or of something decidedly wrong with the engine.

Drains. Compressor intercoolers condense considerable moisture in the air, which must be drained instead of being allowed to pass to the next cylinder. Larger compressors frequently carry automatic drain traps as standard equipment for carrying away this condensate. Purchased traps for smaller machines and aftercoolers make it unnecessary to depend upon the operator to drain condensate manually.

Drains from the steam receiver and cylinders of steam-driven compressors require automatic drain traps.

Oil filters. Most of the larger compressors use force-feed lubrication for the running gear, in which all frame bearings are lubricated under pressure through drilled oil channels. Passing the oil through an approved filter keeps dirt out of the bearings. Such filters are frequently standard equipment on compressors having full-pressure oiling systems that provide definite protection to these parts.

Overspeed shutdown. A steam- or gas-engine-driven compressor, being a variable speed unit, is frequently provided with an overspeed trip. Such a machine has a load-control governor, but if this should stick and the machine overspeed, the tripping device would shut down the compressor. In most gas-engine and duplex steam-driven compressors, this device is standard equipment. It either shorts the magneto or shuts off the gas supply to the engine, or it releases a latch and closes a butterfly valve in the steam-engine supply line. Similar devices for single-cylinder and smaller duplex steam-driven compressors can be purchased separately.

Overspeed devices are desirable on a steam-driven vacuum pump because power for operating such a unit at high vacuum is much less than that required over the peak load. As a result, the steam cylinder is large and the governor must throttle the steam pressure considerably. This surplus power puts a heavy load on the governor, because if it should stick for only a minute and excessive steam pressure reach the engine, it would surely run away. Overspeed trips on vacuum pumps are usually supplied at additional cost.

Oil shutdown. Larger compressors fitted with pressure oilers are frequently provided with an oil alarm or shutdown system. Oil-pressure failure shuts the unit down and thus injury to the bearings is avoided. When shutdown is undesirable for installations that serve process work, an alarm can warn the operator that something is wrong with the oiling system.

Cooling-Water System

Jacket-water valve. In many plants, jacket and intercooler water must be turned on manually, just as a steam-driven compressor is turned on or an electric motor started manually. An automatic water valve, to shut down the unit if water pressure fails, may be operated by either pressure or temperature.

Hot, wet hydrocarbon gases that are compressed will condense within the cylinder when too-cold jacket water is used. (See "Recognize Air-Compressor Troubles by Their Early Symptoms," POWER, July, 1943, pg 79.)

Excessive-pressure shutdown. A pressure switch shuts down a compressor operating without regular attendants if the governor sticks and allows excessive discharge pressure to build up. For a motor-driven machine, this simply means that a pressure switch is set to trip at a higher pressure than usual for a standard compressor regulator. For a gas-engine-driven compressor, the switch, set at a higher pressure than the governor, grounds the magneto. You

(*Continued on page* 150)

THE OLD CHIEF

HONEST GRAFT

A center punch in the body of every used valve

Meet Boss Hookem, who puts up a losing fight for the cheapest valves on the market and ventilating fans that rival African tom-toms. Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario

High on the grounds of the factory that is served by the Old Chief's plant, there stands a four-story building that the employees always refer to as *The New Building*, in spite of the fact that it was built an age ago. From time to time I learned from the Old Chief the story of the battle he was forced to wage against the contractors so that the building might have at least some resemblance to the specifications.

For the benefit of those who were not with us in the old days, I might explain that there existed in our county and in many other counties, a type of individual seldom seen today. He was usually mixed up in all kinds of shady politics, influential in financial circles and too big to bother with the ethics that were respected by ordinary business firms. Our particular example was known as Boss Hookem. He was a builder, but always sublet his contracts. He was not a lawyer, an architect or an engineer, but he had "all kinds of them fellows" in his office.

It was a well-known fact in the trade that whenever Boss Hookem was in on a job, the same plumber, steam fitter, electrician and general contractor were always the low bidders.

The building in question did not present any big problems. About half of it was given over to the finishing and shipping departments. It also afforded some office space, a new sample room, a modern cafeteria and locker space.

The specifications called for wrought-iron pipe, the best valves and fittings on the market (by name), with the usual joker, "or equal," added. Pipe covering was to extend up all "chases" and to continue through all walls. The vacuum-return pump was awarded to a firm that no one could question, and the fans for ventilating the finishing department were an international make, renowned for silence and reliability.

Not an inch of wrought-iron pipe came on the job and, in spite of the Old Chief's protests, the local manager believed that the standard pipe used was far better. No covering of any kind was used in the chases so that roof conductors, steam pipes, vent pipes and hot water pipes were all jammed together. Boss Hookem said that insulating them was a lot of poppycock. The Old Chief stormed to no avail.

War Starts

Then came a letter from the head office to the local manager that they had received complaints that the Old Chief was "unduly interfering with and hampering the contractors in their work, and would he cease from doing so."

Next came the valves. They were the cheapest on the market. And along with them came a big box full of used and misused valves which the bright steam fitters started to slip into all the out of the way places. This was too much for the Old Chief. He went to work with a hammer and started to drive a center punch into the body of a used valve wherever he found one. Boss Hookem swore he would have him fired and called him a Socialist—a terrible name in those days.

Later, he came along with a big handshake and a handful of cigars, which he placed in the Chief's desk drawer. He said he would check up on that damned steam fitter so it would give no more trouble. Unfortunately, he moaned, he was unable to secure the duplex vacuum pump that was specified, but he was going to install a much better one, and he mentioned a jobbing firm that had a very low name.

In the case of the ventilating fans a letter came from the head office, stating that they had agreed to a change in the make of fans. When they were installed, they made more noise than all the tom-toms in Africa.

On the day that all the big shots came to inspect The New Building, the Old Chief placed a "jumper" in each switch so that the fans could not be cut out, and stationed one of his men to throw in the fuses whenever the party entered the finishing shop. The effect was wonderful. Everyone dived for the switches. Everyone was shouting above the noise of the fans. The net result was that the fans were removed.

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Do You Want Your Gear Speed Reducers to Run Better Longer?

Then follow these simple rules for their selection, installation, maintenance and lubrication by W F Plume, application engineer, Philadelphia Gear Works

MOST MANUFACTURERS cover the essential points for maintaining gear speed reducers in their catalogs and instruction books, but operators sometimes overlook or ignore these instructions. And when equipment is installed and placed in service without proper study of operation requirements, serious abuse with early failures and expensive shutdowns often results. Accordingly, maintenance information should be available for designers and operators to digest thoroughly. This is especially important now that inexperienced men are frequently responsible for operation, and replacement parts and new machines are difficult to procure.

Since intelligent maintenance of gear speed reducers begins with selection and installation, consider the following points to help get better service and longer life.

Select size and type of unit by actual load conditions. If the user supplies complete data on load and speed requirements, responsibility rests with the gear manufacturer to recommend proper size and type. To increase the life of gear speed reducers, select them with an adequate safety factor.

Use the simplest equipment arrangement: wherever possible a single-speed reducer rather than two or more separate pieces of equipment in series. This reduces maintenance, increases efficiency and, in many cases, reduces initial cost.

Check for vibration caused by nearby equipment. If it is likely to be severe, insulate the speed-reducer mounting from the vibration source. Design foundations and mounting for permanent alignment of prime mover, speed reducer and driven machine. Provide a cast-iron or steel baseplate wherever possible. If the plant atmosphere is laden with abrasive dust or corrosive fumes, protect the speed reducer by enclosing it. But if you cannot do this, order from the manufacturer special seals and breathers that keep out dust and fumes.

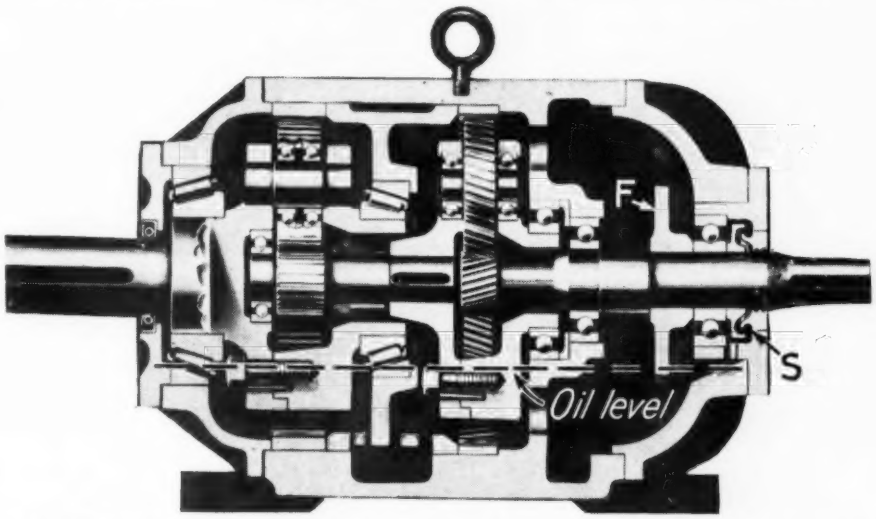


Fig. 1—Double-reduction planetary-gear speed reducer; when at rest it is filled with proper oil to the level marked on the gear case and is splash lubricated

Protect speed reducers from extreme temperature changes. Oil viscosity must be kept within safe limits for adequate lubrication. Use flexible rather than rigid couplings to connect motor to speed reducer and speed reducer to the driven load. This is especially important for the motor shaft, to allow for end float and for slight misalignment without overloading bearings and shafts.

Where a long, heavy agitator is hung from a vertical speed reducer, install a guide bearing well down on its shaft to prevent whipping. For an overhung load beyond speed-reducer capacity, install an outboard bearing to help take the load off the speed-reducer output shaft bearing. Provide rigid mounting to insure permanent alignment under all load conditions.

See that foundations are level and

sturdy. Bring all equipment into perfect alignment and dowel in place. Take care in mounting couplings, sprockets and pinions on the shafts. Never drive them on. Heat by some safe means and push them onto the shaft. Before assembling, check shaft diameter and gear-bore size to make sure that a proper press fit will result. Too heavy a fit will give the mechanic a headache when he dismantles the unit. Too light a fit allows the coupling, sprocket or pinion to creep along the shaft and possibly damage the equipment during operation.

Never start a speed reducer for the first time until all gears and bearings have been properly lubricated. Speed reducers are shipped without oil because it would leak out in transit. Every speed reducer has its own lubrication system designed to suit best the particular application. It is important, therefore, to make a thorough study of the lubrication method used for gears and bearings. Let's consider several typical lubrication systems to bring out the different methods and designs.

Fig. 1 shows a planetary double-reduction speed reducer. When at rest, it is filled with the proper oil to the level marked on the gear case, and is splash lubricated. When the unit runs, the revolving gears and spiders dip into the oil bath and spray oil on all gears and bearings above the oil level. On the high-speed shaft the flinger, *F*, throws oil to the casing top from where it drains into the outer bearing. Without the flinger this bearing, which is sealed to the outside by a labyrinth seal, *S*, would be too far from the gears to receive proper lubrication.

For splash lubrication, check the oil for cleanliness and proper level at regular periods. After three weeks' operation of a new unit, it is good practice to replace the oil, which may then be filtered and used again. Thereafter, change it normally about twice a year.

Horizontal Worm and Gear

Fig. 2 and 3 show a splash-lubricated horizontal worm and gear. In the assembly, Fig. 2, correct oil level is the center line of the worm shaft. The worm carries the oil to the gear mesh and the bearings are in oil baths. Note that a stuffing box is needed to seal a head of oil. Tighten packing *P* just enough to hold the oil. Tight packing heats excessively, wears and scores the shaft.

Fig. 3 is a section through the gear shaft. Here separate oil levels for each low-speed bearing are maintained by special wells *W* which fill up to the overflow point *L* when oil is poured into the fill hole, and remain at the correct level for lubricating the bearings. When changing oil, draw it off from the wells by removing the drain plugs.

In some motorized single-planetary speed reducers the gear end is splash lubricated, but the outboard armature shaft bearing has grease lubrication. Therefore, in addition to checking oil level, give attention to greasing the motor bearing.

Use a good grade of soda-soap grease that does not flow at operating temperatures. Do not pack the bearing space full, because an excessive amount produces overheating which, in turn, causes the grease to separate into a soapy base and an oil. If the soapy base becomes hard, its abrasive action causes early failure of the bearing.

When installing a new bearing thoroughly smear the end cap with grease, and fill the bearing housing about one-third full. Thereafter, add only small amounts of grease from two to six times a year, depending on the severity and duration of operation. If possible, clean out the grease about once a year.

Fig. 4 shows greased bearings in a vertical worm and gear. Here, again, oil level is at the center line of the worm shaft. Ordinarily, a stuffing box is required for a vertical shaft extending downward. To get away from packing maintenance problems, as well as to make the speed reducer leak-proof, use a dry well, *W*. It extends up inside the gear a safe distance above the oil level to keep the oil away from shaft and lower bearings. The latter is lubricated through a grease fitting, *G*, and a standard seal prevents grease leaking out along the shaft. The upper bearing is in such a position that oil splash does not reach it; therefore, it also is grease lubricated through fitting *F*.

Fig. 5 shows a typical lubrication system for a high-speed helical-gear speed reducer, used for speed-increaser drives or for steam-turbine reduction gears, where a speed reduction may be required of from, say, 4000 to 1200 rpm.

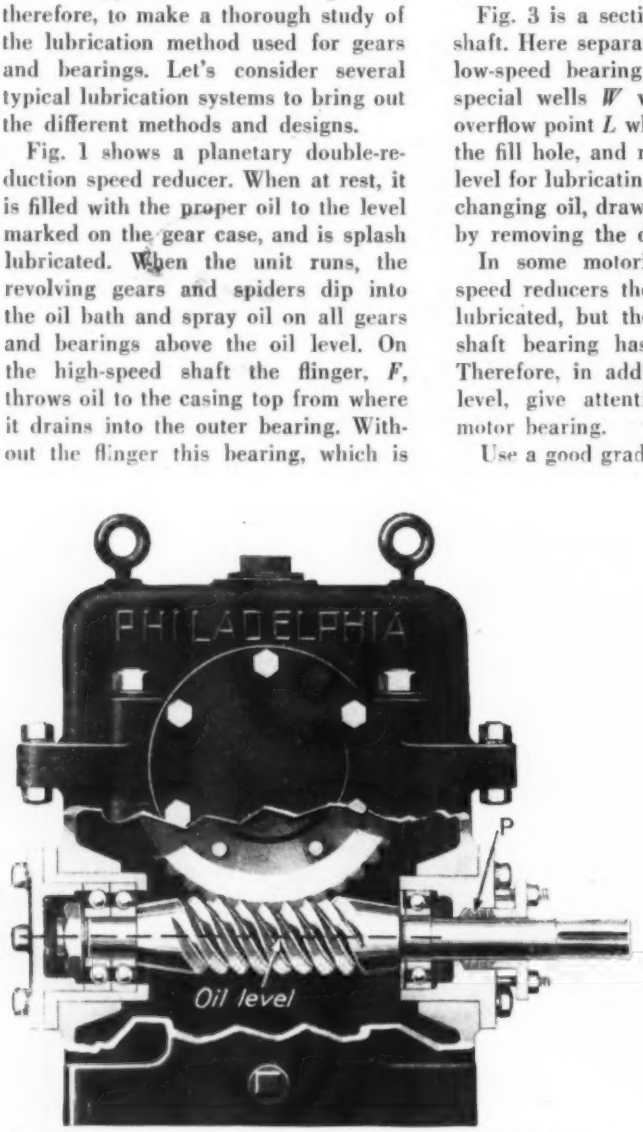


Fig. 2—Section through worm shaft of horizontal worm-gear speed reducer lubricated by the correct oil level coming up to the center line of the worm shaft

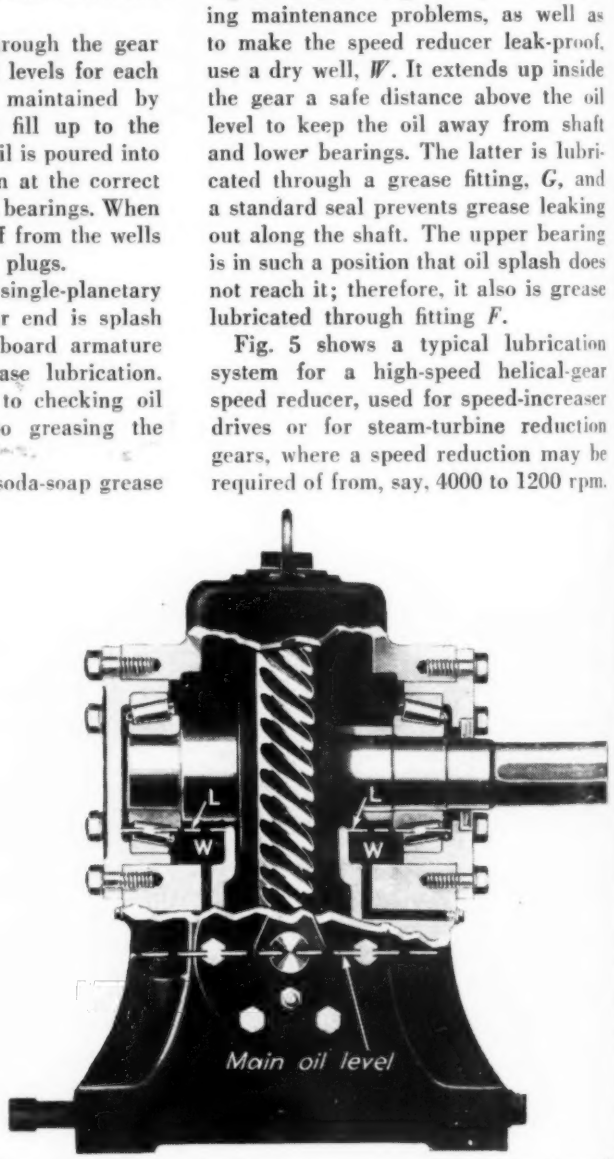


Fig. 3—Section through worm-gear shaft of horizontal worm-gear speed reducer with gear-shaft bearings lubricated from wells, *W*, having a maximum oil level *L*

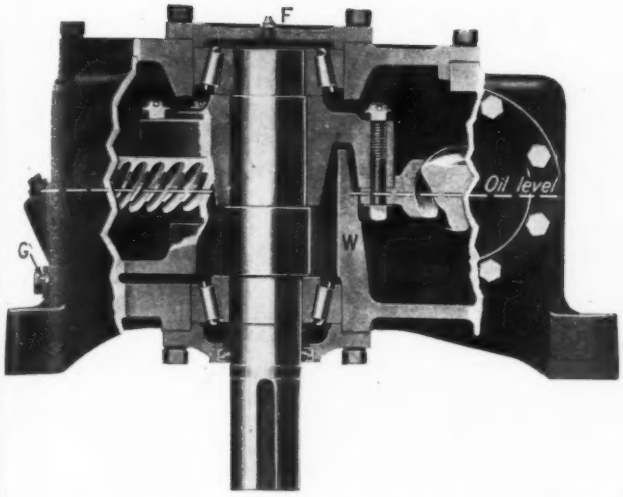


Fig. 4—Section through gear shaft of oil-lubricated vertical worm-gear speed reducer, with gear-shaft bearings grease-lubricated through fittings *G* and *F* (above)

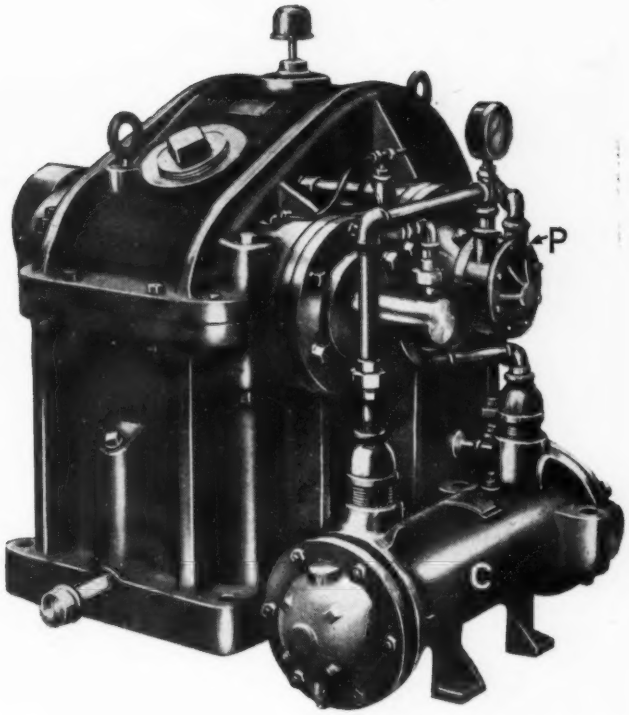


Fig. 5—This high-speed high-capacity helical-gear speed reducer is lubricated by a forced oil-circulating system, the oil being cooled in an external cooler (right)

High-speed gears with low-speed ratios have proportionately high horsepower capacity for a given size gear case. This increases heat because of friction losses, even for high efficiency. Since the increase cannot be dissipated in the normal way from the gear case at safe operating temperatures, an oil cooler is used. In Fig. 5, pump *P* circulates the oil from the gear case through an oil cooler *C* and then back into the gear case to the gear and bearing spray pipes. Heat is carried away from the gear mesh by the oil spray, from which it is transferred to the circulating water in the oil cooler. Pump *P* connects directly to the low-speed shaft which usually runs between 1800 and 900 rpm.

For high-pitch-line gear velocities, a splash system cannot adequately lubricate the gears. They churn the oil and generate excessive heat, and throw off the oil by centrifugal force before it reaches the gear mesh.

These lubrication systems demonstrate the importance of thoroughly understanding the system of any speed reducer before putting it in operation. Many machines have been wrecked by neglecting to fill the case with oil to the proper level, overlooking the greasing of one or more bearings, or allowing pumped lubrication to fail because of clogged strainers or other faults.

Noise or change in its sound quality or increase in operating temperature usually accompanies trouble in a speed reducer. When either of these warning signs appears, shut down the machine immediately and open it for inspection, preferably when the manufacturer's representative is present.

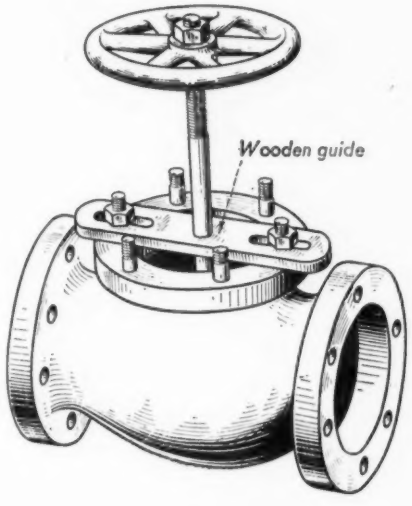
Pitting of teeth may result from oil with too low viscosity which, in turn, results from an operating temperature higher than that specified in the original design. In most cases, this is corrected by changing to oil of higher viscosity. Slight initial pitting is not harmful and disappears in service after the cause has been corrected. When a new unit, whose parts are mechanically correct, overheats, the cure may be a reduction in oil viscosity or lowering of the oil level. If teeth are scratched or rough on the contact side, look for coarse, abrasive dirt in the oil, which should be drained out and filtered.

If the unit has non-adjustable antifriction bearings worn so as to give play in the shaft, replace the bearings. This condition is caused by fine abrasives in the oil, and although they may not be harmful to the gears, ball bearings that have been lapped to a point where considerable play exists between balls and races are no longer fit for service. Their load capacity drops off rapidly and the movement of the shafts causes misalignment of the gears. For adjustable antifriction bearings, play in the shaft may be taken up by removing the necessary shims from the bearing cap.

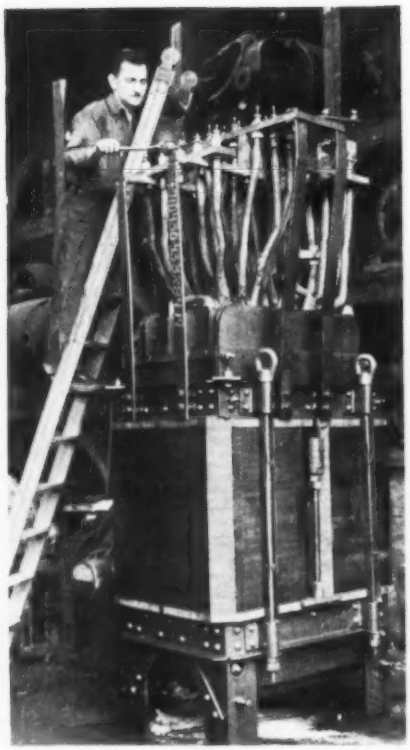
Wise operating engineers do not wait for warning signs but inspect their speed reducers regularly. Correcting trouble in the early stages keeps existing equipment working longer and relieves overtaxed manufacturers of replacing unnecessary parts.

Wooden Guide for Grinding Valve Seats

AT TIMES I HAVE FOUND it difficult to use a valve bonnet as a valve stem guide when grinding in the valve disk to its seat. When this occurs I have always been able to solve the problem with a piece of hard wood, as in the diagram. The wood is bored so that the hole in its center for the valve stem can be centered on the valve seat. The center hole must make a close fit on the stem so that it will form an accurate guide when it is bolted to the valve body. From here on the job is done the same as when the bonnet is used as a guide. —S M ELONKA

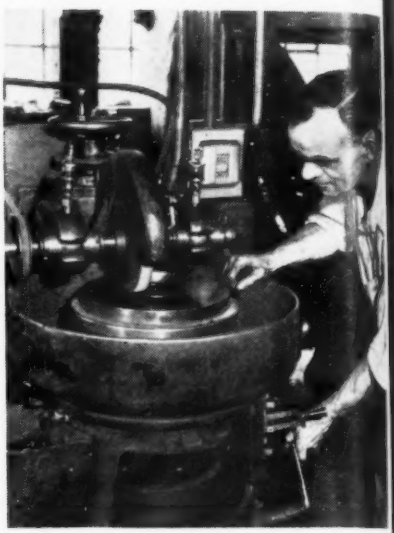


IF YOU CAN'T BUY A NEW MACHINE—



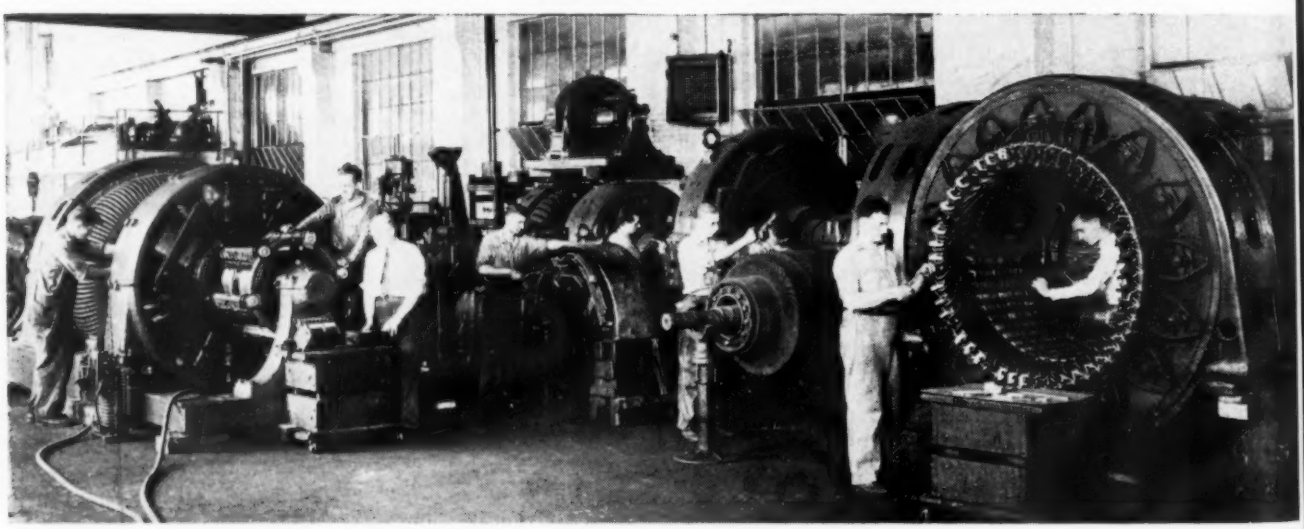
Reconnecting 4-section secondary on 13,000/2400-v transformer to operate in parallel at 600 v; higher capacity secondary terminals also installed

Now being insulation tested, 400-hp 150-rpm 25-cycle single-bearing motor has been rewound for 800-hp 360-rpm 440-v 60-cycle, with a second bearing



Valve-plate grinder for circular shapes. Plates slightly worn or carbonized are resurfaced to a smooth flat finish; others go to the scrap pile

Careful attention during all stages of repair is followed by extensive tests that show up potential weakness before machine leaves the shop. Motor generator at left receives final check before delivery to an important war job



TODAY'S power engineer tightens his belt, so to speak, and struggles along with what equipment he can lay his hands on when metals and new machines are scarce. If he happens to have an old boiler, turbine, motor or other piece of equipment around the plant, he overhauls it and puts it to work. But what about the engineer whose plant has no spare equipment? Regardless of his priority rating, he faces WPB regulation L-221 which states that orders for new motors and generators will not be considered until after the would-be purchaser investigates three sources of used machinery.

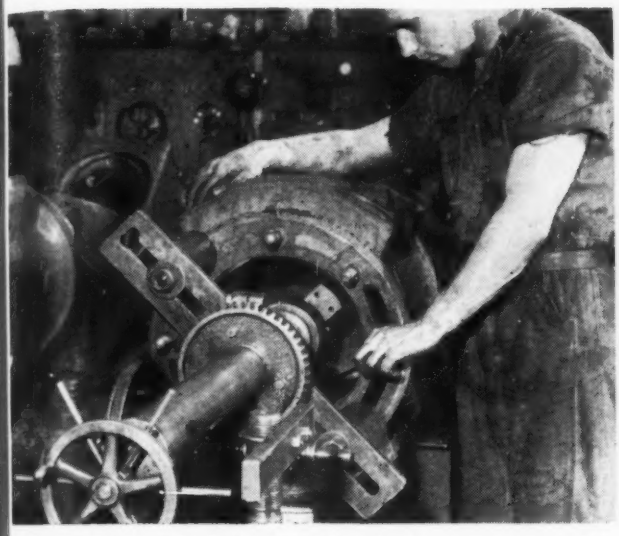
Armed with WPB's list of these sources, the engineer may solve his problem in the used-machinery market. One of Power's editors, in a recent visit to representative used-machinery shops, found them a substantial source of supply, worthy of investigation by any power engineer needing equipment.

Resale method varies with the dealer. An engineer who wants to make his own overhaul may buy a machine "as is." The dealer gives him a description of the unit and allows him to inspect it. This puts the results strictly up to the buyer. Some dealers do a large part of their business this way.

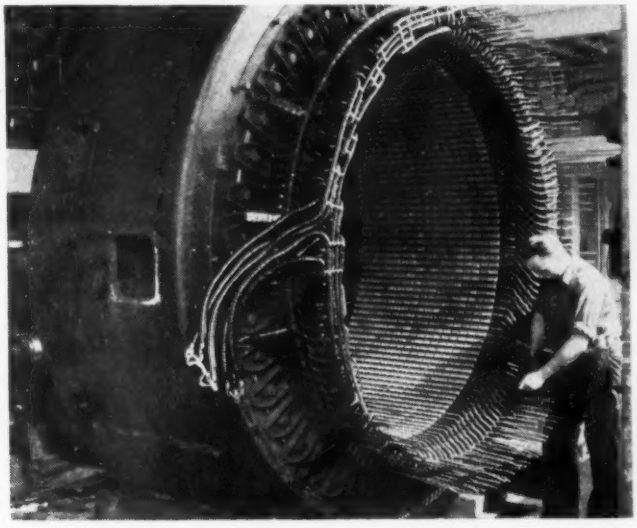
Other dealers might be called "remanufacturers" because most of their orders call for machinery remodeled for special requirements. They overhaul vir-

See if a used-equipment dealer can meet your specifications for rebuilding or reconditioning one. Besides producing mechanically sound machinery, rebuilding shops save critical materials

Photographs courtesy of American Air Compressor Corp, Belyea Co Inc and J L Hemphill & Co.



Shop equipment includes portable boring bar that speeds up production when regular boring mill is busy. Handwheel spokes hit striking bar and advance tool feed



This 4000-kva, 13,200-v synchronous condenser, fitted with new coils to correct pf in an ordnance plant, saved erecting an additional transmission line from main power source

In this corner of the shop, a separate department handles repair and coil rewinding for small motors. After rewinding, coils are carefully insulated, dried and varnished

After a comprehensive mechanical overhaul, air compressors receive a discharge-capacity test. Operation continues until bearings are "run-in" to final adjustment

tually every machine that leaves their shops and with this inside knowledge of equipment condition can protect the buyer by guaranteeing material and workmanship.

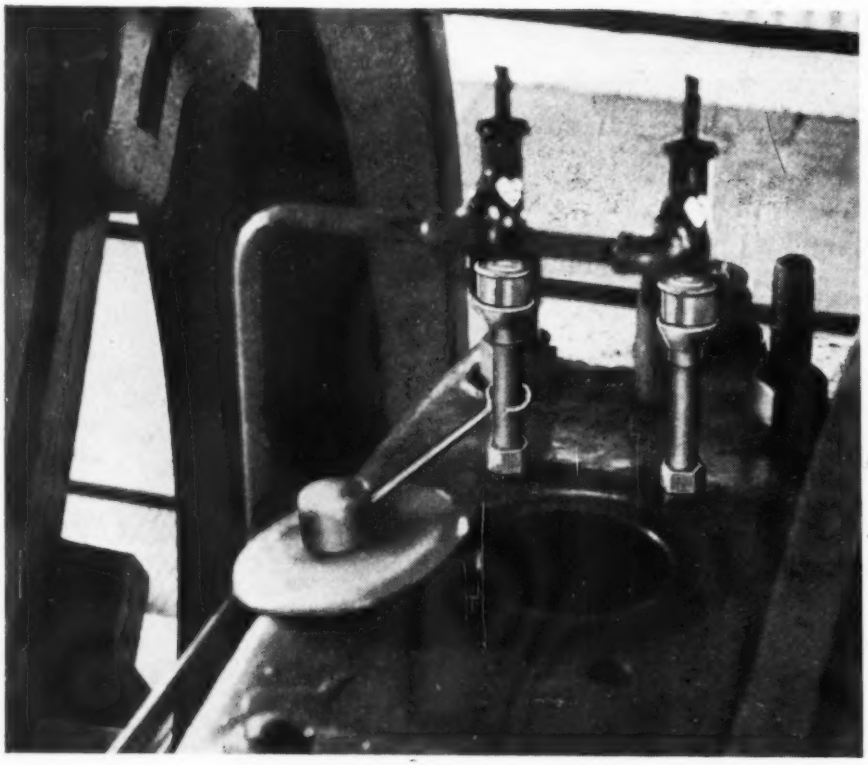
Electrical machinery coming into the shop receives an insulation-resistance check before it goes to the warehouse. When an item is sold, it is brought back to the shop for complete overhaul. Insulation is tested, and new windings or coil leads are installed if needed. Slip-rings or commutators are resurfaced and fitted with new brushes. Worn bearings are replaced or rebabbitted. Before the machine leaves the shop, the windings are dried, varnished and given a "hi-pot" and running test to uncover any hidden weak spots.

Generally the customer's detailed specifications arrive before overhaul begins; no material is added to or work done on stock equipment beforehand. This method holds to a minimum the capital tied up in stock inventories, and also permits the buyer to get exactly what he needs—even changes in design or special combinations—custom built to meet his specificatons.

Requests for specially arranged machines form an interesting feature of the used-machinery shop's work. For example, one customer requested a 600-kw motor-generator set consisting of a 4150-v synchronous motor driving

(*Continued on page* 154)

PRACTICAL AIDS TO OPERATION



Applies Safety First to Bearing Inspection

SMALL AND ALMOST insignificant changes may mean a great deal in safe operation. As an example, in one plant there was danger that the operator might let the cast-iron covers over the inspection holes in the tops of large bearings fall into a flywheel. This hazard was eliminated by fastening the covers so that they could not fall off the bearing. Each cover had a lifting knob through which the operator drilled a horizontal hole large enough for a piece of bronze welding rod to pass through with a small clearance.

On one end of the rod he cut a short thread and after making the rod the correct length to reach to a vertical oil pipe, he formed a loop in the rod to go around this pipe. He then put the threaded end of the rod though the hole in the cover knob, put on the nut and upset the end of the rod to prevent the nut from coming off. With the cover in place he closed the loop in the rod around the oil pipe. Now when an inspection hole is opened its cover is moved to one side, as in the photo, and the rod keeps it from getting away from the operator.

Santa Monica, Calif. J C ALBRIGHT

Avoid Excessive Compressed-Air Temperatures

INSUFFICIENT COOLING of air-compressor cylinder walls frequently causes operating and maintenance troubles. Excessive cylinder temperatures carbonizes the lubricating oil, a condition responsible for increased wear of rubbing surfaces, valve difficulties and reduced clearance volume. Under these conditions temperatures may become high enough to ignite oil vapors and produce explosive forces that may wreck the compressor, its piping and receiver.

Failure of the cooling-water system is a common cause of high cylinder temperatures. This may be result from complete stoppage of cooling-water flow, but more frequently from poor heat transfer from cylinder walls to water because of scale on the water jacket and insufficient water flow. Cylinder-wall temperature is frequently judged by the temperature of the cooling water leaving the water jacket. This may be misleading, because when the jacket has a heavy coat of scale, heat cannot readily flow from cylinder walls to the water. As a result even with a restricted flow of water its discharge temperature may be well within limits that would indicate safe cylinder-wall temperatures when they are excessively high for safe and economical operation.

Measuring temperature of air leaving the compressor is the only accurate means of determining the effectiveness of the cooling system. Air-temperature records should be supplemented with measurements of cooling-water flow to determine cooling efficiency. When properly used, these records conserve cooling water and show when scale removal from the cooling system becomes necessary.

In one plant a calibrated flow-control valve in the cooling-water inlet line provides a simple method of measuring the water flow. Here the water pressure remains fairly constant. When the water jacket is clean the valve is set to give the desired discharge air temperature. Then, as scale forms on the water jacket the control valve has to be opened more to maintain correct discharge air temperature. By noting relation between the control valve opening and air temperature we can get an idea when the water jacket should be cleaned.

Richmond, Va. C R ANDERSON

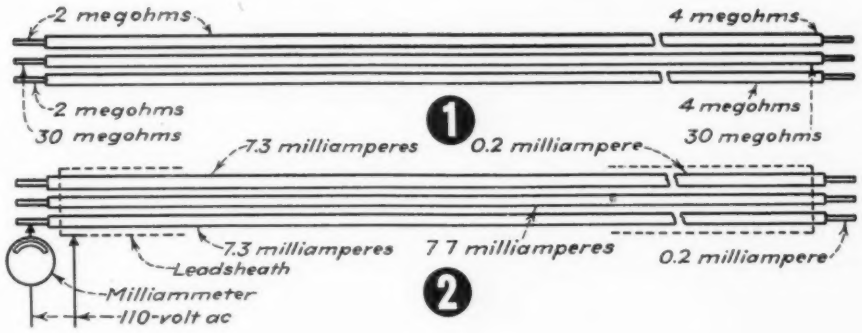
Locates Cable Fault With Milliammeter

ONE OF OUR 2300-VOLT, 3-phase lead-covered underground cables failed. Continuity tests showed that two of the conductors had opened and that the other was complete. A megger test between each conductor and the lead sheath obtained the readings shown in Fig. 1. One of the local utility engineers was called in on the problem but was not able to give much help other than to suggest applying sufficient voltage to the faulted conductors to break down their insulation to ground. Since the defective cable was one of a group of six, all buried together we were afraid to expose the good cables to possible damage from the arc that might

form if the faulty cable were broken down to ground.

To locate the fault we connected the grounded side of a 110-volt ac line to the lead sheath. The other leg of the ac line we connected through an ac milliameter and to each conductor at both ends of the cable. Fig. 2 shows the milliampere reading obtained from this test.

At the right-hand end of the cable 0.2 milliampere flowed into the cable where at the left-hand end, the current reached 7.3 milliamperes. This placed the break near the end where the low-current readings were obtained. This fact in itself would have saved us a lot of digging.

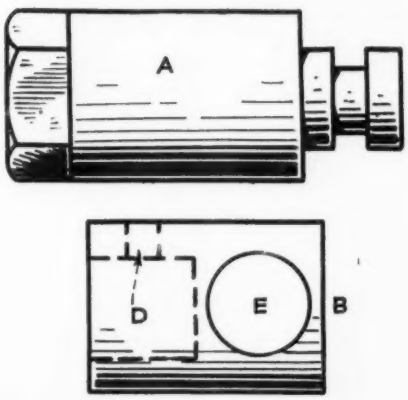
We then measured the length of the distance between manholes, which was 1016 ft. By proportioning the milliampere readings to the total length of cable we got the expressions $X = (1016 \times 7.3) \div 7.7 = 963$ ft, and $X = (1016 \times 0.2) \div 7.7 = 26$ ft, where X represents the distance of the fault from each end of the cable. The two values total only $963 + 26 = 989$ ft, a difference of $1016 - 989 = 27$ ft between the calculated and actual length of the cable. This, however, was quite close considering that our test equipment was not as highly accurate as might be desired.

We decided that the error in the long length of cable should be less than in the short one so we started digging 52 ft from the manhole nearest the fault. The break was found 58 ft from this manhole, so we missed it by only 6 ft, which was pretty good considering everything.

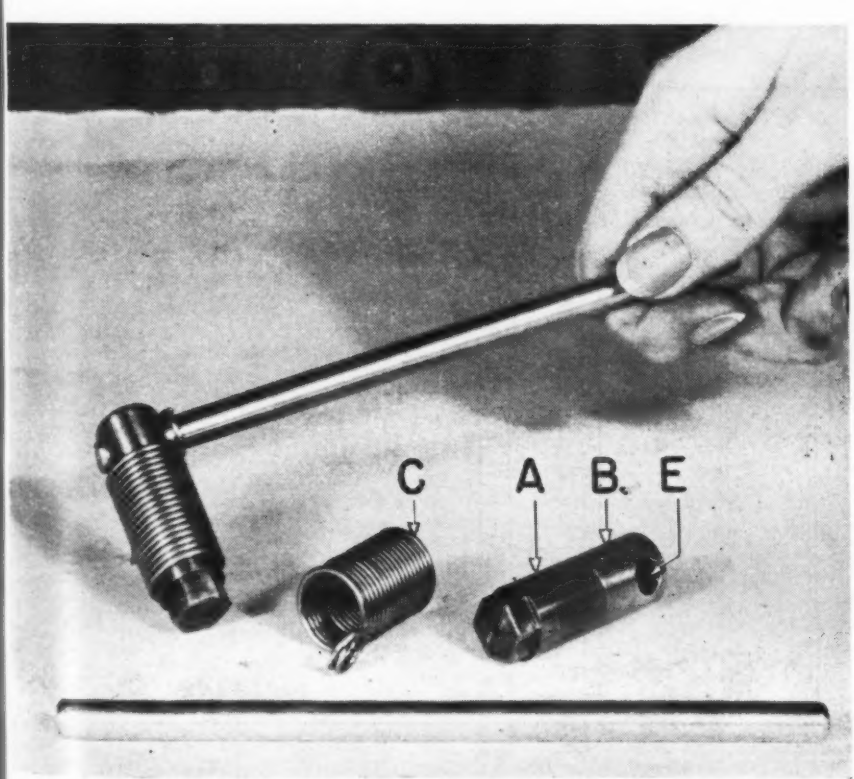
This method of locating a fault in a power cable may be helpful to others faced with a similar problem.

St. Louis, Mo. ALBERT A. SCHULKE

Makes a Ratchetless Ratchet Wrench

WHEN INSPECTORS and maintenance men in the induction furnace department at General Electric's Schenectady works found it necessary to reach a considerable number of hollow-head screws in out-of-the-way places, inspector Raymond Hodge solved the problem by devising a ratchetless ratchet wrench of small diameter. The body of the wrench comprises two cylindrical parts *A* and *B* as in the diagram. Part *A* inserts in *B* with a pin through hole *D* extending into the groove in *A*, permitting free turning without separation. Spring *C* in the photo is tightly wound on a mandrel 0.005 in. smaller than the diameter of *A* and *B* and is pressed over them with the loop of the spring over hole *E*. Inserting a 5/16-in. rod through the spring loop and into hole *E* locks the looped end of the spring to *B*, as in the photo.





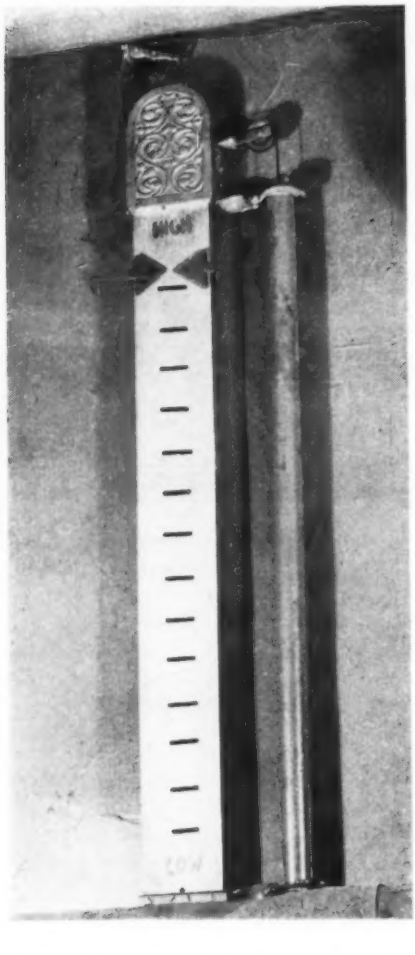
If the spring is wound clockwise, any clockwise movement of the rod tends to tighten the spring, grip on *A*, and tighten the hollow-head screw. Moving the rod counterclockwise loosens the spring, permitting *B* and the spring to turn without turning *A*. By a series of short back-and-forth movements of the rod it is possible to drive the screw with the wrench. If the coil is wound counterclockwise, then such a back-and-forth movement removes the screw. The wrench was made to accommodate ½-in. hexagonal head, but adaptors may be used for other screws.

Mr Hodge provided two wrenches for

the work: one, with a clockwise-wound spring for use as a driver and painted red for easy identification, and the other with a counterclockwise-wound spring for removing the screws.

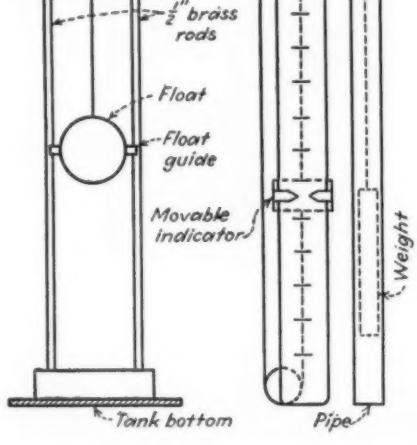
Hangs Up Water Level Where It Can Be Seen

THE 20,000-GAL SURGE tank on the hydraulic elevators in Washington Life Building, New York City, is located where it is not convenient to observe the water level, even if a level indicator were mounted on the tank. To eliminate this difficulty, I made a gage



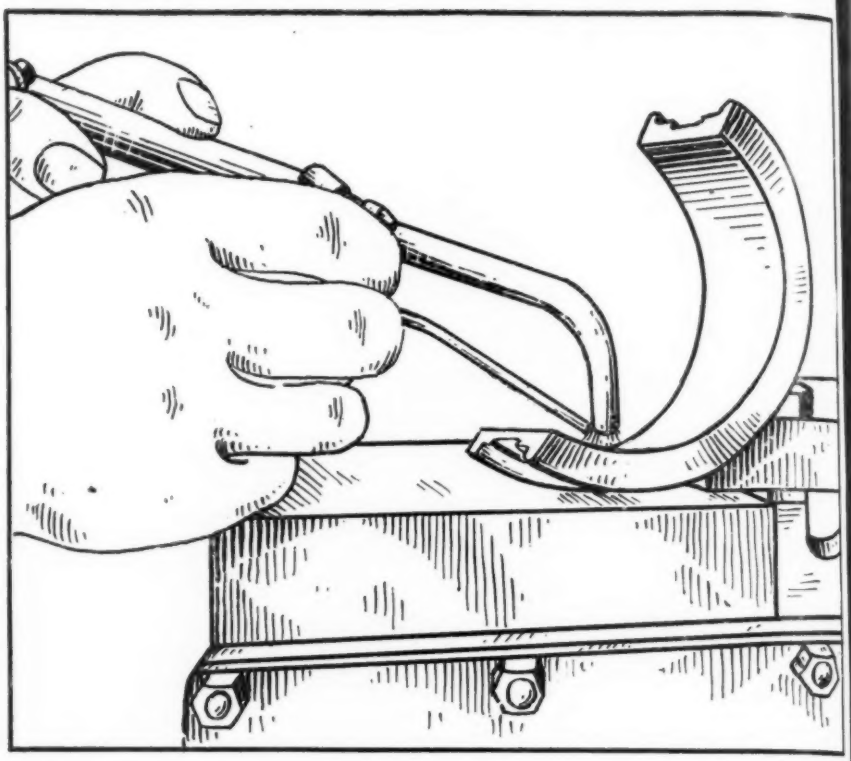
and, placing it where it can be seen easily from the engine-room floor, connected it by a flexible wire to a float in the tank, as indicated in the diagram.

Guides are attached to the side of the float so that it moves up and down freely between two ½-in. brass rods supported in the surge tank. The indicator consists simply of a piece of board painted with division marks on it, as in the photo. The bottom edge of a movable indicator on the back of the board, with pointers coming around to the front, connects to the float. The top edge of this indicator connects to a weight guided in a pipe, see diagram.



With this arrangement the indicator moves in the same direction as the float. If the tank is full the indicator is at the top of the scale, as in the photo; when the water level is getting low the indicator is at the bottom of the scale.

New York, N. Y. ALBERT FISCHER



Brazing Torch Repairs Bearings

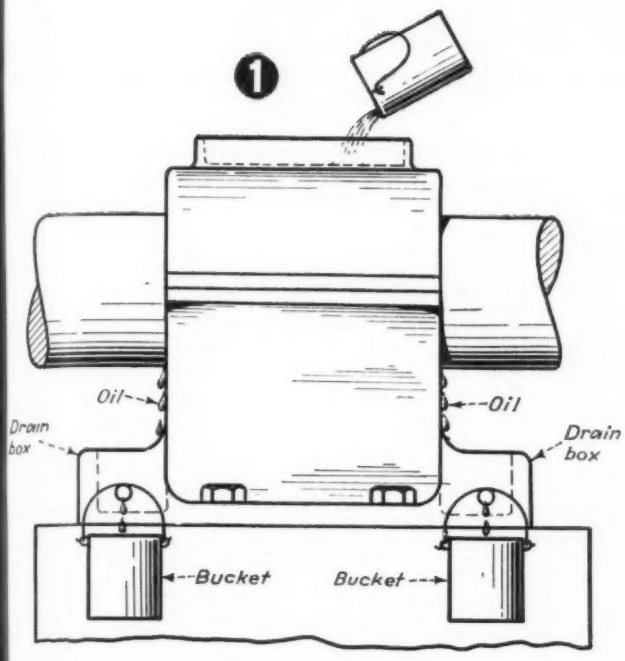
REPLACING BEARINGS with new ones is now almost impossible because of war restrictions, so that repair of these parts is a real necessity. Recently when one company overhauled some engines, connecting-rod bearings were found damaged by washouts and cracks. To repair these bearings the washouts were filled by puddling high-grade babbitt into them with a small brazing torch, as in the figure, after tinning the surface of the worn places. When the worn areas had been filled to beyond the bearing contour, excess babbitt was removed by bearing scrapers and checked with bearing blue to get a good fit on the journal. These renewed bearing inserts may not be as good as new ones, but they are good for several months.

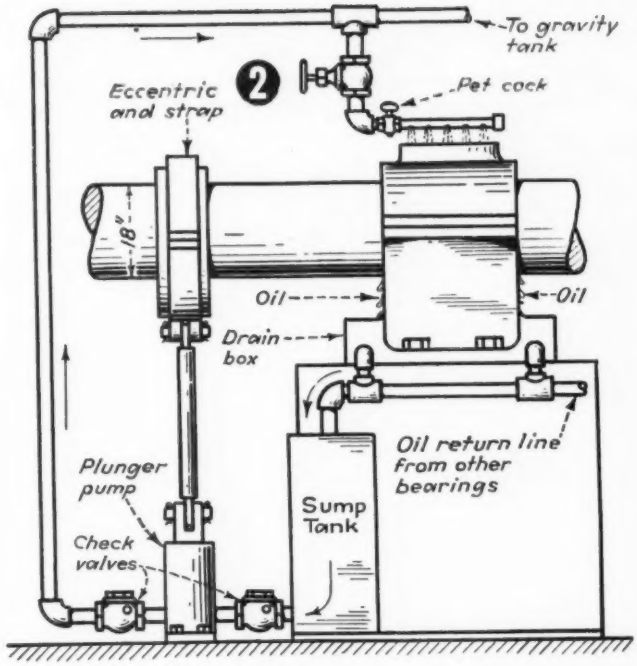
Santa Monica, Calif. J C ALBRIGHT

Substitutes One Type Insulator for Another

WHEN YOU CAN'T GET what you want, the only thing to do is to make the most of what you have. This is just what we did recently when we needed some pipe-mounting insulators for heavy cable supports, but had only wall-mounting ones in stock. Being unable to purchase the pipe-mounting insulators, we turned our attention to the wall-mounting ones.

These we mounted on the pipe by





Makes His Own Oil-Circulating System

MAYBE AN OLD MARINE ENGINEER will be permitted to make a suggestion to his stationary brothers concerning an oil-circulating system that saved a lot of work and oil. Eight bearings on a propeller shaft were wick lubricated. Oil was poured on wicking in the top of the bearing housings, from where it fed to the shaft. After passing through the bearings the oil leaked out at the bearing ends and down to drain boxes that emptied into buckets, as in Fig. 1. These bearings needed attention every hour, and, in addition, the oil made a mess around the bearings that had to be cleaned up.

To correct these conditions I built and installed the gravity recirculating lubrication system shown in Fig. 2. All drain boxes were connected to a common return line. A gravity tank with a gage glass to show the oil level in it was installed in the engine room. This tank we piped to all bearings and fed the oil into them through $\frac{1}{16}$-in. holes in a $\frac{3}{8}$-in. pipe, regulating the flow with a petcock.

To circulate the oil I built a simple plunger pump and operated it from an eccentric having a 2-in. throw on the propeller shaft. Two check valves served as suction and discharge valves on the pump. Suction of this pump was connected to a sump tank and the discharge line ran to the bearings and gravity tank, as shown. The sump tank was made of sufficient capacity to hold all the oil in the system, which operated satisfactorily for several years until the ship was sunk, or it probably would still be in service.

Great Neck, N. Y. S M ELONKA

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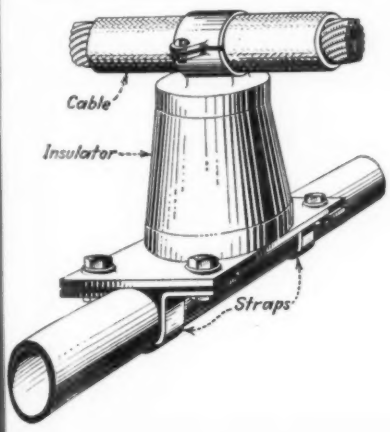
straps that would just about go around the pipe. Four bolts connected two straps to the flat base of each insulator, as shown in the figure. The bolts and straps held the insulators firmly in place and did the job well.

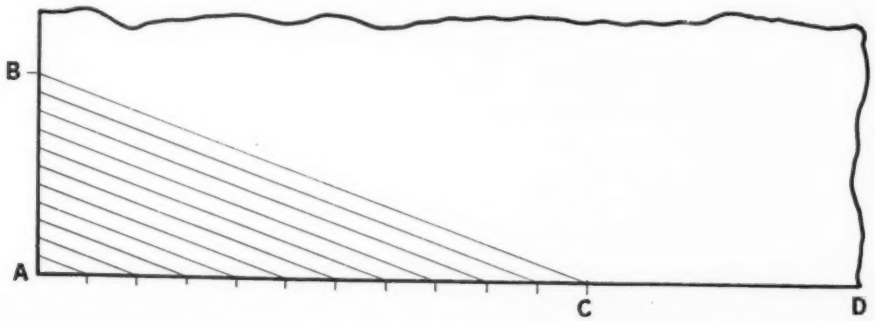
Philadelphia, Pa. R O SPENCER



Scale With an Odd Number of Divisions

SOMETIMES ENGINEERS need a scale with odd divisions not usually found on scales, such as, sevenths, ninths or elevenths of an inch. Such scales can be easily constructed as indicated in the figure. On the base line *AD* lay off in quarter inches the number of divisions in which you are going to divide the inch, say 11, *AC* in the figure. On the vertical line lay off one-inch from *A*, or *AB*. Connect *B* and *C* with a line. Then from each quarter-inch division draw a line to *AB* parallel to *BC*, as shown. This gives the same number of equally spaced divisions on line *AB* as on *AC*.

Detroit, Mich. NELSON HALL



READERS' PROBLEMS

Questions from Our Readers

Needs Suction Pressure Control

Question 1

WE HAVE TWO *diesel-driven ammonia compressors, each direct-connected to a lighting generator in our ice making plant. Since the generators require constant-speed drive, ammonia suction pressure varies considerably over a 24-hr period.*

A brine temperature of 16 F requires 30 psi suction pressure, which we maintain without difficulty over the heavier ice load periods. Frequently the refrigerating load changes, and the suction pressure drops as low as 15 psi. Naturally we want to save oil instead of wasting it and are investigating the possibilities of partially unloading the compressor.

The cylinders are fitted with clearance pockets and the necessary valves but no control equipment is installed. Rough measurements indicate that clearance volume is about 5% of cylinder volume or enough to raise the suction pressure an appreciable amount.

Could we expect any substantial saving if the compressor operates with this extra clearance? How could the valves be controlled to cut in at 20 psi suction pressure with a minimum of equipment?—MOC

Valves Won't Regulate

Question 2

SEVERAL FILTERED-WATER LINES *supplying water to different elevations in our plant are each equipped with a pressure reducing valve. A small spring-opposed metal-diaphragm pilot valve operated by downstream water pressure controls the main valve diaphragm. The lines feed washrooms, air-compressor jackets, drinking fountains and other outlets and only rarely must the valves regulate against dead-end pressure.*

We have been unable to adjust the valves so that they will maintain anything like a steady pressure. Line pressure surges continuously sometimes as high as 40 psi. For example, on one line we try to maintain 60 psi but the pressure-gage hand swings almost continually from 40 to 80 psi. Main- and pilot-valve seats are in good condition, and the needle-bleed valve, on the line between pilot and main diaphragm, is unobstructed.

No amount of cleaning or adjustment improves valve operation and I am at a loss to understand the reason for this annoying pressure fluctuation. It is impossible to keep drinking fountains adjusted: one second the water just trickles from the mouthpiece and the next second it squirts a 2-ft stream. What can we do to remedy this situation?—DWL

SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers accompanied by practical drawings or photographs will command additional pay.

Answers to July Question 1

Can Water Tank Be Painted?.

The Question

THE WATER SUPPLY *for our plant sprinkler system comes from a 100,000-gal elevated storage tank through an underground steel pipe. A leak must have developed in this line because originally we added water only once a week to keep the tank filled and now we must add this water daily. Is there any method we can use to find this leak without uncovering the line?*

We also have a filtered-water storage tank situated on a hill considerably higher than the plant. The filling line goes from the plant to the tank and also feeds plant service as well as several homes near the tank. Normal pressure ranges from 40 psi at the dwellings to 125 psi in the plant. Pumps run intermittently to keep the tank filled.

The tank is badly corroded and to do the necessary cleaning and painting will require the tank remaining empty for at least one week. Water service must be maintained and the pump shutoff pressure is too high to run directly on the main without the tank in service. This pressure is considerably higher than release pressure of the many hot water relief valves. Pump motors operate at constant speed. Can POWER *readers suggest some way of running the pumps on this line with the storage tank out of service?—HS*

Erect An Overflow Line

IF HS'S LINE is not too deep, a steel rod pushed down through the earth at points along the pipe will show if water is present. Of course, if the line is buried in wet ground this will not work. If the line can be emptied and put under 100 psi air pressure, the air escaping through the leak may be heard and in that way the hole located. Listening with the ear against an iron rod driven down against the pipe will locate leaks because the sound of escaping water will increase in intensity the nearer the rod approaches the leak.

HS can throttle his pumps and reduce the water-service pressure to the dwellings mentioned while cleaning the filtered water tank. This will require close attention as the pressure will vary and the choking will have to be below the point where excessive pressure will build up. An open-end overflow pipe extended to the level of the high-water mark in the tank, will serve to relieve excess pressure and maintain the head on the line. Unless the pumps are of high capacity, a 2- or 3-in. overflow will keep the pressure within safe limits.

Carlsbad, N. M. E A ROBERTS

Line Within A Line

HERE'S HOW WE FOUND leaks in an underground line: We separated the line from the supply tank by capping at a convenient point. We then used a plant pump to maintain sufficient water pressure on the defective line until the leak showed up at the surface at the least expected place. This pipe was buried about eight feet below ground level and it required some time for the water to penetrate to the surface.

HS should investigate the advantage of replacing the entire underground line, which may be corroded externally (unless it is cast iron). That was true

in our case and all effort and time was wasted trying to locate the leak. After learning that external corrosion was responsible for the trouble, we proceeded to install a second underground line parallel with the old one. According to available records the old underground pipe served 18 years. Therefore we anticipated prolonging the life of the second installation by using soil pipe as a protector. In other words, using a line within a line to prevent or minimize external corrosion.

As to the second question, we must assume that the storage tank floats on the line (surge tank) to take care of maximum demands. Of course, HS could operate his pump or pumps directly on the line with the tank out of service. Nevertheless if he feels that the pressure shutoff point of the pressure switch is too high without the tank, intermediate-pressure shutoff point can be selected with the same pressure switch. However, operating the pump or pumps intermittently is out during the cleaning period.

He did not state whether reciprocating or centrifugal pumps are installed. In any case it is advisable to run a relief line, with its relief valve set at the desired pressure, from the discharge line back to and into the suction line. This will safeguard either type of pump during zero flow if the pressure control switch should not function properly.

Schenectady, N. Y. CARL BACHMANN

Fill Line With Air

HS does not state what type of control equipment he has on the motors. If he has a pressure gage for motor shutoff it should be set so that at maximum pressure the pump will cut out. The same applies when the minimum pressure which should be determined by frequent trials, has been reached. That is when the minimum pressure wanted is developed, the switch to the motor compensator will cut-in. A small supply line in the discharge side of the pump line will control the pressure supply to the pressure gage (shown in sketch).

There is a method by which HS may detect leaks in the underground water supply and that is by shutting the valves off at the tank itself and at the discharge side of the pump. An air line should be tapped in and air admitted to the pipeline. The ground above the pipe should be covered by at least 1 in. of water, so that any air leaks will be detected readily by minute bubbles rising to the surface of the artificial pond.

Fairview, N. J. M N GOZDENOVICH

Partition The Tank

IF HS's TANK is of rectangular design he can solve his problem by partitioning it so that he can use one side while the other half is being cleaned and painted.

If it is not convenient to partition the tank the next best thing is to connect the pump discharge, by means of crossover valves underneath or close to the bottom of the tank, to the supply line and to install pressure reducing and regulating valves on the 40 psi system.

We must assume from the question that pump shutoff pressure is at least 125 psi so that the pump will take care of plant requirements. Of course he will have to make the required changes in the motor controller, as his problem indicates that the motor is started and stopped by a float-operated switch in the tank.

If he installs a pressure gage at each end of the underground line, where it enters and leaves the ground, leakage will be indicated by an excessive pressure drop across or through the line as shown by the pressure gage where the pipe emerges from the ground.

New York, N. Y. PAT DONOHUE

Operate Both Services At Lower Pressure

SINCE THE WATER PRESSURE in HS's plant is 125 psi and the dwellings are served at 40 psi he must provide a relief or regulator to prevent opening the hot water relief valves when the tank is closed off. The main reason for this change is to supply water to the plant and village at the same pressure as before. If the plant service can be supplied at 40 psi, I would operate both services at the lower pressures.

Another method would be to run the pump on the dead-ended line using a return back to pump suction. A relief valve set for 128 psi, in the 125-psi line, will bleed excess pressure into the return and prevent tripping of hot water reliefs when water usage is low.

Philadelphia, Pa. W T MULLEN

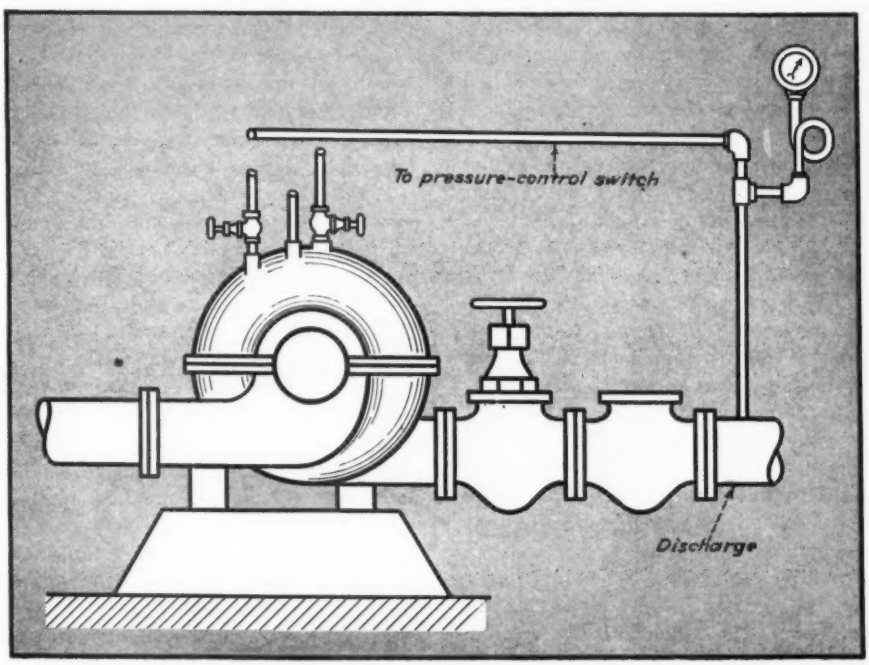
Simple Listening Device

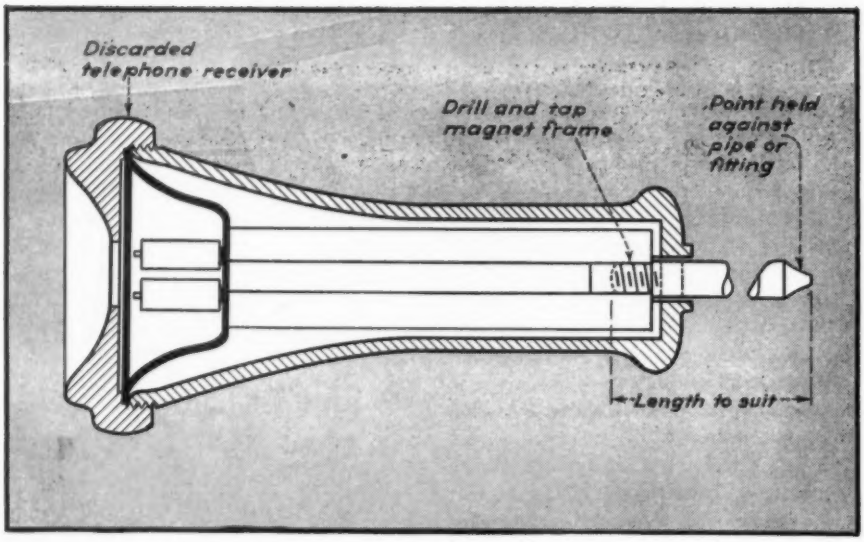
HS SHOULD FIRST CHECK the sprinkler tank temperature and heating system to make sure the loss is not caused by evaporation.

To locate underground leaks use the simple testing device shown in the sketch on page 118. If the tank line has intermediate valves or other connections above ground, the listening device measuring sound intensity at each point will determine the approximate location and save a lot of labor. Even a very small leak will be readily heard in the receiver.

In connection with cleaning and painting the filtered water tank, no details are given about present control equipment. Presumably complete automatic control would not be warranted for the short time the tank must be out of service. A simple method would be to install a relief valve at the pump discharge line feeding back to the pump suction or sump. The number of pumps in service can be adjusted to give minimum relief valve operation.

Other alternatives would be temporary installation of a variable-speed pis-





ton pump, a centrifugal pump having a flat pressure characteristic curve in the operating range required, or a pressure controller with step switches to start and stop the present pumps.

The best method will depend on the system demand, the pressure variations permissible, and the importance of continuous service.

Saint John, N. B. C G CLARK

Answers to July Question 2

Pump Pounds After Quiet Operation

The Question

WE HAVE A NEW *simplex double-acting steam-driven boiler-feed pump that has given us a lot of trouble. Water temperature is around 205 F and discharge pressure 175 psi. The water piston is packed with formed rings of a fabric packing commonly used for the purpose. Before putting the packing on the piston we soak it in hot water to soften and expand it. The packing has scored the bronze cylinder liner and once part of the packing was torn off the piston and got into the feed lines. We thought that the packing may have swelled and become too tight in the cylinder. Working on this theory, we increased the space between the packing flanges on the piston until there was lost motion between the packing and the piston, without correcting the trouble. Faces of the bronze valves have also started to pit. Chemists have tested the feedwater and report that it contains nothing that would attack the valves or liners. At times the pump pounds so badly that we have to shut down to prevent the piping joints from loosening. These pounding periods start after several hours of quiet operation. There is a total positive static suction head on the pump of 15 feet, and the suction line is short, direct and large for this size pump. Can* POWER *readers tell us what causes this liner scoring and the serious pounding?—AGF*

Tight Packing Scores Cylinders

WHEN PACKING reciprocating pump pistons it is important to provide clearance between the packing and pistons radially. Severe scoring of cylinder liners comes from packing fitted too tightly to allow adjustment as temperature and pressure conditions change. Foreign matter in the water may contribute to the scoring. Piston flange diameter should support the packing without allowing any wedging action to take place between the flange and liner.

If the water analysis shows that corrosion is not to be expected, pitting of valve faces is probably caused by oxygen. If a deaerating heater is used its operation should be carefully checked.

The pounding described by AGF can be caused by steam formation in the cylinder, by faulty valves or valve operation, or by other factors, depending on the installation details. A steam engine indicator applied to the water and steam ends in turn should show the cause of the trouble.

The normal suction head required for a temperature of 205 F is 11 to 13 feet static, hence any throttling by valves or foreign matter in the suction line would cause steam to form. As this is a new pump the supplier should be consulted as to installation details and faults that have developed in service.

Saint John, N. B. C G CLARK

Install Vacuum Chamber On Suction

AGF MAY FIND IT to his advantage to check up on the quality of the packing he is using in the pump. If the bronze cylinder is scored or worn he should carefully remove it and rebore it in a lathe. If a hand boring tool is available, the liner may be bored in place.

Sometimes, after inspection, it will be found that packing used may be too hard.

If a pump is run at an excessive speed it will pound; to overcome this condition install a vacuum chamber in the suction line close to the pump. Some pumps also carry a chamber on top of the water end casing. Many chambers use a glass so that the proper water level may be seen. Vacuum chambers should show about 75% of water level.

Other troubles found in pumps or related equipment are: Liquid in the suction well too low, inflow to the well too close to the suction pipe, leaky suction line, or leaky packing around the plungers or the suction valves.

Excessive head on the pump, loose crosshead or crankpin and bearings will cause erratic pump operation.

Fairview, N. J. M N GOZDENOVICH

Heater Vent Obstructed?

AGF SEEMS TO HAVE DAMAGED the liners of his pump in an effort to remedy a condition caused by high water temperature and too much tension on the suction valve springs. The high temperature is necessary, of course, and must be compensated for otherwise. However, excessive tension of the suction valve springs is not only unnecessary, it is certain to cause trouble and loss of capacity when pumping hot water. If AGF will watch his pump and heater thermometer closely, he will likely find that the pounding becomes more severe as the water temperature rises, other things being the same.

In pumping hot water four things can partly or wholly nullify a positive static suction head and oversize unobstructed line. These are:

1. Obstructed vent and supply line of the heater.
2. Suction valves with too small an

(*Continued on page* 120)

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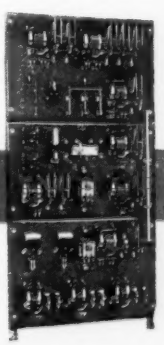

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MOTOR CONTROL
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orifice for the pump piston displacement.

3. Insufficient valve lift.

4. Excessive valve spring tension.

When cold water is pumped a closed or obstructed vent in the supply tank hinders the liquid flow into the cylinder, because this flow then must take place unassisted by atmospheric pressure. However, the tendency to bind in a closed suction supply decreases with an increase in water temperature, until at 212 F and barometric reading of 30 in. there would be no difference in a vented and unvented supply tank. At this temperature vapor pressure would equal atmospheric pressure and prevent a partial vacuum from forming above the water in the tank.

At 205 F this vapor pressure is approximately 13 psi abs. With the heater well vented, there would still be about 2 psi suction lift caused by atmospheric pressure, and would assist the static head of 6 psi (15 ft) in opening the suction valves and filling the cylinders on the suction stroke. But with the vent closed this 2 psi would have to be subtracted from the static head, leaving only 4 psi to overcome friction, weight of valve and spring tension.

Almost anyone can close a spring between the thumb and forefinger that requires 50 lb of weights to close it on a scale. This is enough pressure to keep a 3x1-in. annular opening valve (6 sq in. cross-section) closed against a head of 40 ft of water. Where spring tension is set by wrench and screw, as in the case of duplex pump valves, it may be too high for the suction pressures.

On pumps operating with positive suction heads spring tension may be greater than where the cylinders must be filled by atmospheric pressure only. But under no conditions should the springs have more tension than that necessary to seat the valves before the piston begins its discharge stroke. Even if the valves have not quite closed, they will not slam at low or moderate piston speeds. A rule of thumb I have for a 4- or 5-in. disk is to hook my little-finger nails under opposite sides of the disk and lift. If the quick of my fingers hurt, there is too much tension on the spring.

Scoring the liners and tearing the piston packing can be caused by cutting packing rings with outside diameter too large for the bore of the liner. And if the nut was backed off until there was lost motion between the rings and the follower plate, there is no wonder that pieces of the packing dragged over the end plates, scored the cylinder liner and wound up in the discharge lines. By all means, the packing rings should be cut accurately and held firmly, although not too tightly together, on the piston.

For pumps handling hot water, cold water or brine, one of the best materials for packing rings is old canvas belting. Rings may be cut from this by bent cutters held in a brace. They should be of the same size as the liner bore, but swelled slightly by tightening up the nut against the follower plate. Rings of this material swell very little when they get wet, and consequently are less likely to score the liner.

Marissa, Ill. GEORGE HOLMAN

Keep Air Chamber Charged

VIOLENT JARRING AND TREMBLING of AGF's pump arises when the delivery air chamber becomes filled with water. Water in contact with air has a tendency to absorb it. Therefore it does not make any difference how free of leaks the air chamber may be, it will gradually lose its air charge and become waterlogged. The rate of loss of air will be much faster at high pressures than at low. The air chamber should be recharged by the air-charging pump or air compressor.

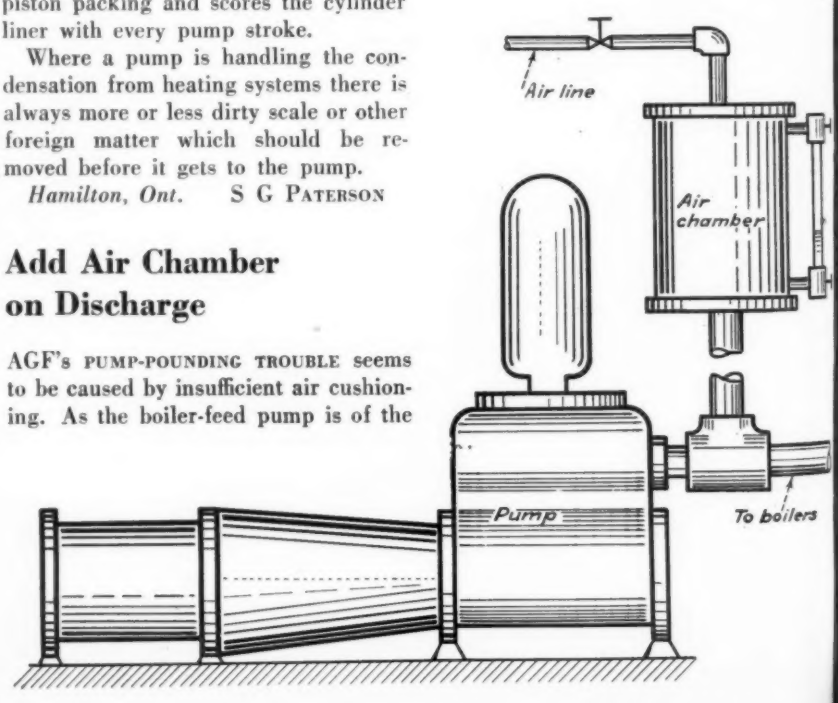
The scoring of the pump liner is no doubt caused by grit or scale in the water which becomes embedded in the piston packing and scores the cylinder liner with every pump stroke.

Where a pump is handling the condensation from heating systems there is always more or less dirty scale or other foreign matter which should be removed before it gets to the pump.

Hamilton, Ont. S G PATERSON

Add Air Chamber on Discharge

AGF's PUMP-POUNDING TROUBLE seems to be caused by insufficient air cushioning. As the boiler-feed pump is of the simplex type, the heavy pulsations at the beginning of each stroke will have to be cushioned by an air chamber on the boiler feed line, as shown in the sketch. This air chamber can be made from a piece of large pipe flanged to the existing feed line. If compressed air is available to fill the air chamber, so much the better.



The liner scoring seems to be caused by grit and dirt in the feedwater.

I suggest that AGF use a good grade of duck and rubber hot-water packing on his pump plunger and that he check his heater to insure that the feedwater is properly filtered.

Bronx, N. Y. ANTHONY GREER

Reduce Feed Temperature

I HAVE HAD TROUBLE similar to AGF's many times and the only way I ever remedied it was to introduce cooler water either into the condensate tank or directly into the suction line. I have had every bit of packing chip up and pass over into the lines and jam the check valves. I tried every other means to stop the trouble but met with no success. By installing a cool-water line running to the condensate tank, which on one occasion served as the makeup line also, I eliminated the trouble entirely.

In my present plant, we have a positive suction head of about 40 ft, our feedwater is about 150 to 200 F. We still get a certain amount of pounding but only when the pumps operate above their normal speed.

The fact that AGF's pump runs ser-

(*Continued on page* 154)

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Q&A QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

6—*Stays, Staybolts, Joint Calculations*

Sixth in a series that is running in every number of POWER. *From long experience as a professional and practical engineer, Alex Higgins asks and answers some direct questions regarding power equipment—its construction, principle, maintenance, efficiency and safe operation. In outstanding fashion he drills the young power engineer, polishes up the oldtimer's knowledge, helps all comers pass engineer examinations and win certificates of higher grade. Besides being invaluable as a study course for examinations, it is a good review for the chief himself who wants to do a better job.—Editor*

Q 1—Why are stays necessary in boiler construction?

A—Flat surfaces exposed to pressure tend to bulge outward; hence they must be supported by stays. Cylindrical or spherical surfaces do not tend to change their shape under pressure and so do not require staying.

Q 2—Sketch a through stay and explain where it is used.

A—Through stays are used to support widely spaced parallel flat surfaces, such as front and rear heads of return tubular and dry-back boilers. They are long, round bars threaded on the ends with a fine thread and fitted with nuts and washers to secure ends of stay to plates and make a steam-tight and watertight joint. When the outer nut would be exposed to excessive heat (as, for example, on the rear head of a return-tubular boiler) an eye is forged on the end of the stay; it is fastened to the rear head by a pin and angle irons. To avoid exposing a double thickness of metal to the furnace heat at this point, the angle iron may be separated a few inches from the head by distance pieces riveted to the angle iron and to the head. Both methods are shown in Fig. 1.

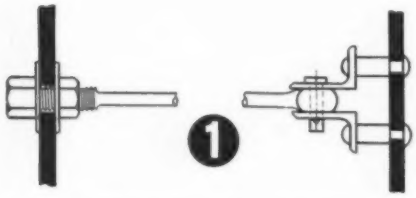

Fig. 1—Through stay, showing two methods of fastening to shell

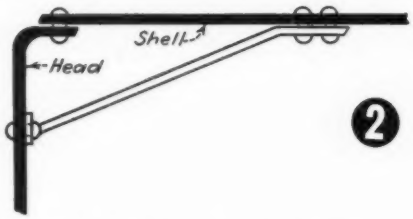

Fig. 2—A typical diagonal stay

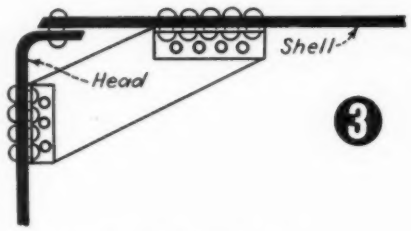

Fig. 3—A typical gusset stay

Q 3—Sketch and describe a diagonal stay and explain where it is used.

A—It is used for the same purpose as the through stay, that is, to stay the flat portions of cylindrical-shell heads that are not supported by the tubes. It is not so direct as the through stay, and it throws stress on the shell plates as well, but it leaves more room above the tubes for inspection, repair and cleaning. A common form of diagonal stay is shown in Fig. 2.

Q 4—Sketch and describe a gusset stay.

A—A form of diagonal stay in which a plate is used instead of a bar. As illustrated in Fig. 3, it consists of a heavy plate fastened by rivets and angle bars to the head and shell. It is more rigid than the diagonal stay, takes up more room and interferes to a greater extent with water circulation. Gusset stays are used very little in modern boiler construction.

Q 5—How are curved locomotive-boiler crownsheets usually supported?

A—They are supported by long threaded rods called radial stays, Fig. 4. These rods are screwed through both crownsheet and wrapper sheet and the ends are riveted over.

Q 6—Sketch and describe some forms of staybolts.

A—They are short staybars to support flat surfaces that are only a short distance apart, such as inner and outer sheets of the water legs in a locomotive boiler. A plain staybolt, *A* in Fig. 5, is simply a piece of round iron or steel bar, threaded its entire length with a fine thread (12 threads per inch) screwed through both sheets and riveted over on each end. Staybolt at *B* has the threads turned off on center part, or sometimes bolt ends are upset to give enough extra diameter to form a thread and leave the central part smooth. This type is a little more flexible than *A* and should be more durable because the bottom of a sharp V-thread is a very likely place for a crack to start. It is also claimed to be less liable to damage by corrosion than the all-threaded staybolt. A still more flexible form, with ball and

(*Continued on page* 124)

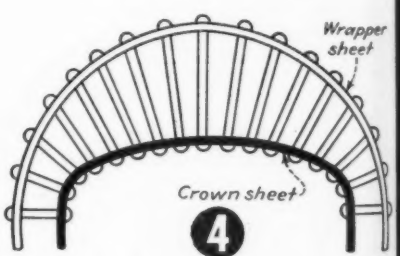

Fig. 4 — Crownsheet supported by radial stays

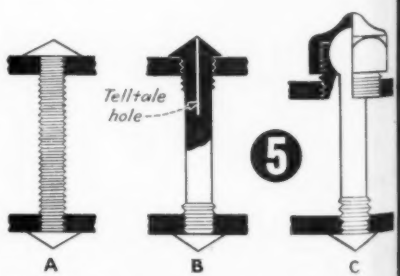

Fig. 5—Types of staybolts

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"stop carbon trouble and rings sticking . . . reduce number of oil changes"

War puts a severe strain on diesel engines, too. Heavier loads . . . longer runs . . . make proper lubrication more important now than ever.

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(Continued from page 122)

socket joint on one end, is shown at *C*.

Small telltale holes are sometimes drilled in staybolt ends to a depth greater than the thickness of head and plate, so that broken staybolts can be detected by the escape of steam and water. In the case of solid staybolts, detect broken bolts by tapping the heads with a hammer and noticing the sound; this requires some practice.

Q 7—Sketch some methods of connecting inner and outer plates at the bottom of water legs and openings around fire doors or burner openings in locomotive and other types of boilers.

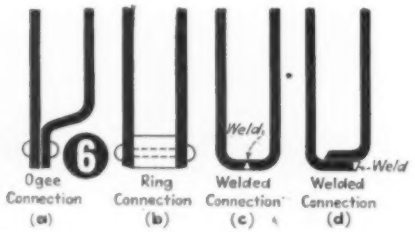

Fig. 6—Ways to join inner and outer plates at bottom of water legs

A—Fig. 6 shows four methods of connecting plates in such cases: (a) an Ogee connection; (b) a solid ring between the plates with connecting rivets passing through ring and plates; (c) plates flanged inward and welded; (d) plates flanged inward but with one flange lapped over the other and welded as shown.

Q 8—What is meant by the efficiency of a riveted joint?

A—Ratio of the strength of a unit section of the joint to the same unit length of solid plate. Unit length usually taken is the pitch of the rivets (distance from center to center) in the row having the greatest pitch.

Q 9—What are the various ways in which a riveted joint may fail?

A—It may fail by: (a) tearing the plate along center line of rivets, (b) shearing the rivets, (c) crushing plates and rivets.

Q 10—What symbols are commonly used in riveted-joint calculations?

A—Following are the symbols commonly used in riveted-joint calculations and their meanings: P = pitch of rivets, inches, in the row having the greatest pitch; d = diameter of rivet after driving, or diameter of rivet hole, inches; a = cross-sectional area of rivet after driving, square inches; t = thickness of plate, inches; b = thickness of butt strap, inches; s = shearing strength of rivet in *single shear*, usually taken as 44,000 psi; S = shearing strength of rivet in *double shear*, usually taken as 88,000 psi; c = crushing strength of mild steel, usually taken as 95,000 psi; T_s = tensile strength of plate metal, usually taken as 55,000 psi; n = number of rivets in *single shear*; N = number of rivets in *double shear*.

Q 11—What is meant by single shear and double shear?

A—When two lapping plates are riveted, as in a lap joint or a single-strap butt joint, there is only one section of each rivet opposing the tendency to shear the rivets through at right angles to their length. In this case, rivets are said to be in single shear, When there are three plate thicknesses in the joint, as in a butt joint with inner and outer straps, two sections of each rivet oppose the shearing stress so the rivets are said to be in double shear.

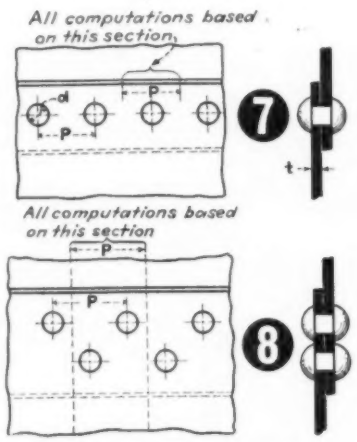

Fig. 7—Single-riveted lap joint

Fig. 8—Double-riveted butt joint

Q 12—How would you find the efficiency of a single-riveted lap joint?

A—Fig. 7 shows this joint. Using the symbols given in the answer to Q 10, there are these four calculations to be made (1, 2, 3, and 4 refer to a length of joint equal to P, the rivet pitch): **(1)** strength of solid plate = $P \times t \times T_s$; **(2)** strength of plate between rivets = $(P - d) \times t \times T_s$; **(3)** shearing strength of *one* rivet in *single shear* (as there is only one rivet in one pitch in this case) = $s \times a$; **(4)** crushing strength of plate in front of *one* rivet = $d \times t \times c$; **(5)** whichever one of 2, 3 or 4 gives the lowest value is divided by No. 1 to give the joint efficiency.

Q 13—What is the efficiency of a single-riveted lap joint having a rivet pitch of 3 in., a rivet diameter of 1¼ in., and a plate thickness of ½ in.?

A—Using substitutes in the formulas given in the preceding answer, the following are obtained (carrying each computation to nearest 100 lb): **(1)** $P \times t \times T_s = 3 \times 0.5 \times 55{,}000 =$ 82,500 lb; **(2)** $(P - d) \times t \times T_s =$ $(3 - 1.25) \times 0.5 \times 55{,}000 =$ 48,100 lb; **(3)** $s \times a = 44{,}000 \times 1.25^2 \times 0.785 =$ 53,900 lb; **(4)** $d \times t \times c =$ $1.25 \times 0.5 \times 95{,}000 =$ 59,400 lb. As **(2)** gives the lowest value, efficiency of joint $= \dfrac{48{,}100}{82{,}500} = 0.583$ *or 58.3% Answer.* This means that plate will fail by tearing the "ligament" between rivet holes and that the strength of this ligament is 58.3% of the strength of the undrilled plate.

Q 14—How do you find the efficiency of a double-riveted lap joint?

A—Here (Fig. 8) calculations are similar to those for the single-riveted lap joint, except that the value of n is 2 instead of 1, because there are *two* rivets in one pitch in a double-riveted lap joint. Thus, **(1)** strength of solid plate = $P \times t \times T_s$; **(2)** strength of plate between rivet holes = $(P - d) \times t \times T_s$; **(3)** shearing strength of *two* rivets in *single* shear = $2 \times s \times a$; **(4)** crushing strength of plate in front of *two* rivets = $2 \times d \times t \times c$.

Q 15—What is the efficiency of a double-riveted lap joint having a rivet pitch of 4 in., a rivet diameter of 1 in., and a plate thickness of ⅜ in.?

A—Using formulas given in pre-

(Continued on page 178)

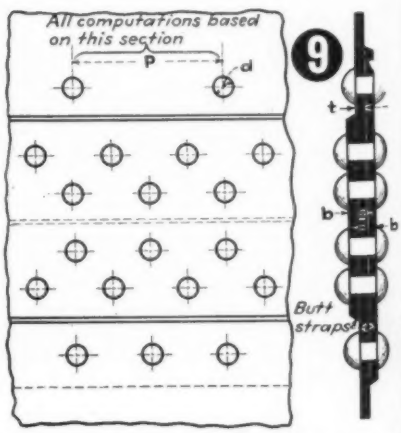

Fig. 9—Triple-riveted butt joint with unequal straps and alternate rivets omitted in outer row

The Alchemists

. . . had a sweet racket

FROM their dingy, sulphurous dens, the alchemists of old issued false promises of a magic formula that would transmute base metals into gold. It was a sweet racket . . . while it lasted. But it finally gave way to scientific advance.

Water treatment ran a similar course until men of science stepped in. Nalco scientists, working in the world's finest water treatment laboratories, have made many original contributions to this work. No problem is so simple that it pays to pass up the possible improvements that can be made at Nalco, none is so complex that Nalco can't solve it.

Call the Nalco man today — he'll help you to help keep 'em firing.

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Photo in Nalco Laboratories

The Complete Water Treating Service

Nalco

REFRIGERATION NOTEBOOK — 6

Learn Money-Saving Ways to Retard Brine Corrosion

By **TERRY MITCHELL, ME,** ***Frick Company***

NOTHING YET FOUND entirely stops brine corrosion in an ice-making tank or piping system but you can save thousands of dollars by retarding it. Cleanliness and careful painting are important; so are regular checks and intelligent chemical treatment carried out as follows:

Brine causes excessive rusting when it (1) is either too alkaline or too acid, (2) carries stray electric currents, (3) is charged with air, or (4) is repeatedly allowed to get warm.

When a few drops of universal indicator solution are added to a small amount of brine, they change color and thus show whether the brine is acid, neutral or alkaline. Brine condition is also measured by what is called its pH value: an arbitrary scale corresponding to the colors listed in the table at the bottom of this column.

The pH value is based on a logarithmic equation, such that a change of one whole unit indicates a tenfold difference in actual brine condition. Thus, pH value of 5.5 is ten times as acid as 6.5. A pH brine-testing kit, containing indicator solution, test tubes, eye droppers, and standard color samples if desired, should be part of plant equipment. Special pH testing paper, which changes color, can be used instead of the solution. Phenolphthalein is also good for tests.

Keep brine either neutral or slightly alkaline, its pH value reading between 7.5 and 8 (or even 8.5 if the galvanizing on the cans has been largely rusted away). To overcome acidity, add caustic soda or lime to brine. Before adding soda, dissolve it in warm water. Suspend freshly slacked lime near the agitator in a bag until a test shows the brine is again alkaline.

pH Value of Brine

Condition	Color	pH Value
Acid	Red	4.0 (or less)
	Orange	5.5
	Yellow	6.5
Neutral	Greenish yellow	7.0
Alkaline	Green	8.0
	Blue	9.5
	Violet	10.0 (or higher)

Brine that becomes too alkaline may have ammonia leaking into it. Test for this with a few drops of Nessler's solution; ammonia or ammonium salts causes a brown or brownish yellow precipitate to form in clear brine. If sodium brine is already colored because sodium dichromate has been added to retard rusting, clear up the brine first by slowly adding a barium salt solution, a drop at a time, and allowing the precipitate to settle. Another way, applicable to either sodium or calcium brine, is to add a little caustic soda to brine being tested, and then apply heat: The ammonia is driven off and can be detected with litmus paper or by its smell.

Test brine once a week. Keep tank and pipelines grounded, but do not run electric current through them as grounds. See that agitators and pumps do not draw in air or carbon dioxide. The latter can be fed into brine, if necessary, to raise its acidity, although it is simpler to add a little acetic or hydrochloric acid or extra dichromate. Keep brine below 40 F, and preferably keep the ice in the cans constantly frozen even when the plant is shut down: Ice crystals and frost stop rusting of cans.

Further long-term protection against rust is gained by using sodium dichromate. Dissolve 125 lb of the bright orange crystals in warm water and add it to each 1000 cu ft of calcium chloride brine: Use 200 lb of dichromate for an equal volume of sodium chloride brine. Smaller quantities will do for temporary installations on brines not excessively corrosive. (In figuring brine capacity of an ice tank, subtract volume of the cans, but not necessarily of the coolers.) Dichromate makes brine more acid; add only one-fourth of it at a time, bringing the brine back to neutral with soda or lime before adding more. For each 100 lb of chromate, 35 lb of 76% commercial flake caustic soda may be required.

Fig. 1—Clear up sodium brine dosed with dichromate before adding Nessler solution for ammonia test

When installing a new tank, mix dichromate with brine and cool the solution before the cans are put in place. Dissolve salt, dichromate and caustic in a separate tank or in barrels; when adding this solution to the clear water in the tank, keep compressor and agitator runing, and hold temperature at or below 40 F. But avoid freezing up coolers or coils.

Never place a few new cans in a tank with old ones unless you have brought the dichromate concentration and the brine pH value up to standard. Otherwise, galvanizing on the new cans may rapidly disappear. If water made into ice is very acid, treat it with sal soda or lime, else the cans will rust on the inside. Acidity is sometimes caused by using aluminum sulphate to coagulate suspended matter in water of low hardness: Sodium aluminate, either alone or with the sulphate, helps check corrosion.

Diesel engines sweep the 7 seas

Diesel engines power mine-sweepers —engines that must not fail these sturdy craft as they plough through heavy seas, clearing the way for troop ships and other Naval vessels. De La Vergne diesels are especially designed for this severe service.

De La Vergne has been a leading name in diesel engine manufacture for fifty years. From educational institutions in New England to pipe line stations in the Southwest; from dredges in the Gulf to cold storage houses in the Northwest—De La Vergne diesels have an enviable record of outstanding service and economical operation and maintenance. These diesels are providing dependable power in whatever service they are used.

BLW THE BALDWIN GROUP

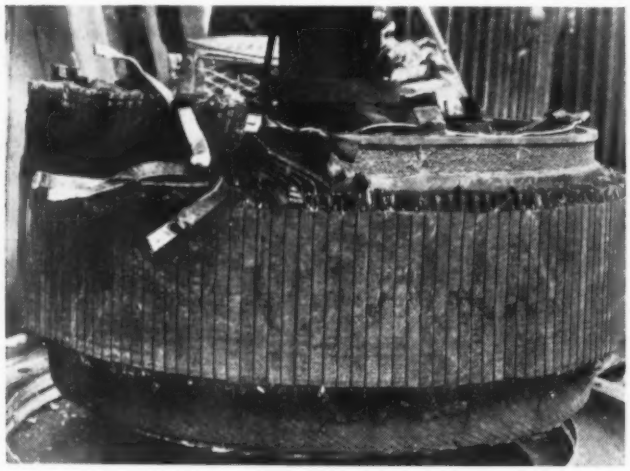
BALDWIN DE LA VERGNE

SALES CORPORATION

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

HOW TO REMOVE ARMATURE OR STATOR COILS

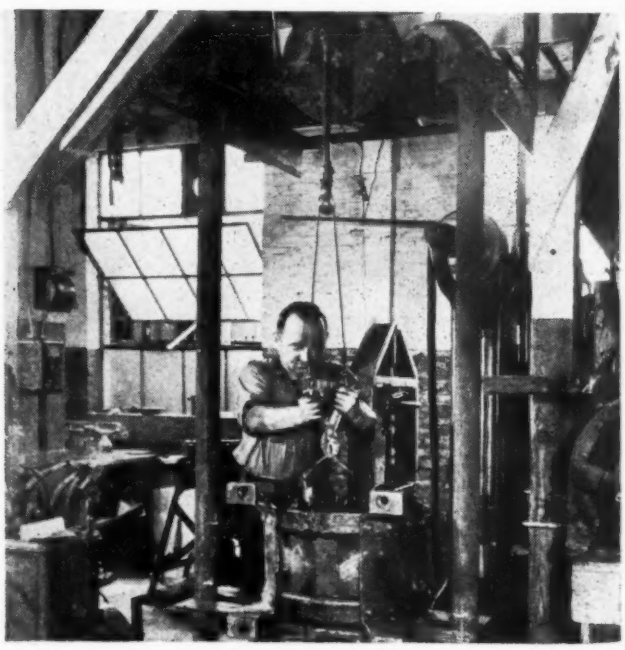
Short cuts taken when rewinding a motor will save considerable time in removing the old winding. Bad coils are usually junked so there is no point in handling them carefully. This method removes the coils quickly without damaging core slot. Photographs courtesy of J L Hemphill & Co, North Bergen, N. J.



1 Lay the rotor or stator on its side so that coils are vertical. Use a bolt cutter and cut off the lower end of coils even with lower face of iron core. (Rotor shown was headed for the junk pile)

2 These three tools fit together, as shown in the next view, to form a strong pulling device for removing the cut-off coils. The small hook and sling hangs from a hoist or block and tackle directly overhead

3 Slip the gas plier's jaws through the ring and hang the ring on small hook. Lower the cable until the open pliers can get a grip on the coil end. Hold the pliers in place and put a strain on hoist cable. This forces ring up pliers handle causing them to grip the coil tightly



4 A permanent puller for the repair shop driven by a back-geared motor. Machine consists of a crank-disk and connecting rod from which hangs a pair of pulling tongs. Disk operates at low speed

Types K and L tubes made in nominal sizes, from ⅛″ up to and including 12″. Type O tube made in nominal sizes from 3″ to 12″ inclusive.

FORESIGHT

Many a busy war plant today is benefitting from the pre-war prudence of those who specified copper tubes for piping. In plant after plant copper tubes are proving their worth by giving round-the-clock service with no need for down-time due to rust-caused repairs.

Easily and economically installed with solder-type fittings, Anaconda Copper Tubes offer many additional advantages.

Pumping costs are lower because their smooth interiors are less resistant to flow. They are rustproof of course . . . save space . . . bend easily. Cost of these tubes, installed, is low due to speed of assembly and the relatively light weight made possible by the elimination of threading. In the event of changes in plant layout, copper tube lines may be disassembled and reinstalled with a minimum of expense.

Present use of copper tubes is drastically curtailed by war demands. But it will pay you to look ahead to the day when this worthwhile piping is again generally available. Publication C-24, sent free on request, describes industrial applications of Anaconda Copper Tubes. 4351

BUY WAR BONDS FOR VICTORY

ANACONDA *Anaconda Copper Tubes*

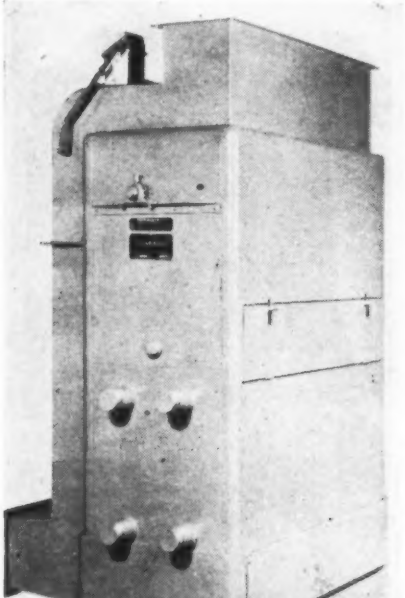
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

WHAT'S NEW IN PLANT EQUIPMENT

Heat Exchanger

NEW DEVELOPMENT for adding heat to industrial liquids for maintaining constant temperatures as desired, with automatic control, is announced. This



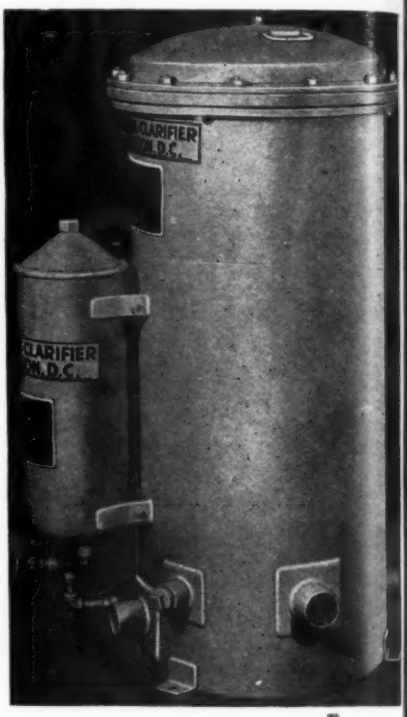
is accomplished by using either a steam coil or injector or an electric heating unit to heat the spray water. This is said to control liquid temperatures within prescribed limits, alternately cooling or heating as required. Heating device is put into operation by thermostatic control at the desired point, preventing the liquid from becoming too cold for the process in which it is used; stopping liquid from becoming viscous with retarded flow and loss of capacity, or eliminating possibility of congealing or freezing. *Niagara Blower Co, 6 E 45th St, New York, 17, N. Y.*

Clear Varnish

SYNTHITE PG-1 clean baking varnish is composed of synthetic resins and vegetable drying oils. One advantage, states maker, is that varnish can be baked to any degree of hardness. Maker says that as Synthite cures by heat-induced chemical polymerization it will not soften even under heat developed by some types of units. *John C Dolph Co, Dept 41, 168 Emmett St, Newark, N. J.*

Filter-Clarifier

FILTER SECTION is equipped with long-fibered cellulose cartridges and is designed to take the complete flow of the system. Clarifier section is designed with sufficient capacity to maintain the oil continuously free of oxidation products and may be operated at will. Unit available in sizes ranging from 5 to 200 gpm. *Briggs Clarifier Co, Washington, D. C.*



Liquid Paint Deodorant

SAID TO BE EQUALLY EFFECTIVE with brush or spray operation, a small quantity of Ridsmel, liquid paint deodorant,

(*Continued on page* 170)

Changing your address soon?

You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

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"PIPING POINTERS"

A SERVICE TO INDUSTRY AT WAR

Helps Train Piping Crews
Helps Conserve Critical Metals
Helps Speed Piping Installations
Helps Keep Pipe Lines Flowing
Helps Get Longer Life from Piping Equipment

As industrial manpower and equipment supplies grow more critical, more and more plants are realizing the usefulness of "Piping Pointers" Bulletins in coping with maintenance problems. Listed above are five major helps these bulletins are giving. Users say there's no end of ways in which this Crane service is helping piping men, both trainees and veterans, do a better job of keeping piping on the job.

Every hint in "Piping Pointers" is sound, practical, authentic. They're based on 88 years of flow control engineering by Crane—world's leading maker of valves and fittings.

HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE
Short-Cuts to Faster Piping Jobs
TIPS ON VALVE TRIM
TO HELP KEEP PIPING ON THE JOB
11 SIMPLE WAYS TO BETTER SERVICE FROM PIPING EQUIPMENT
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
How to Repair Valves

Watch for announcement of "Piping Pointers" sound film now in the making. Ready soon for use in your plant.

FREE TO ANY PLANT

One of its emergency services to industry, Crane offers a supply of "Piping Pointer" Bulletins to any plant requesting them. No obligation. Ask your Crane Representative, or address Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

CRANE VALVES

Machines To Catch Up To . . .

Once, years ago, I wore a wrist brace to work for a couple of weeks. I had a "cranker's wrist"—the Ford kicked while I was cranking it after a heavy rain. That tin Lizzie had a personality—an infernal itch to get even with me for driving it over the chain of ruts we used to dignify by calling a road. I'd always beaten the crank to the punch—but that time the machine got ahead of the man.

Something of the same sort is happening today. I've talked to soldier after soldier who says in effect: "Our fighting equipment is the best in the world—but it's taking a lot of time to teach us how to use it!" A "90-day wonder" Naval officer says: "They told us to 'forget' some of the dials and gadgets on our submarine-detection equipment. That made us think it was overcomplicated, and not much good. Then I met a sailor who understood it; he knew what all the dials were for—and why. I learned how to use it from him. Now I know our equipment is far ahead of that of any other country—it's only some of the operators that are behind."

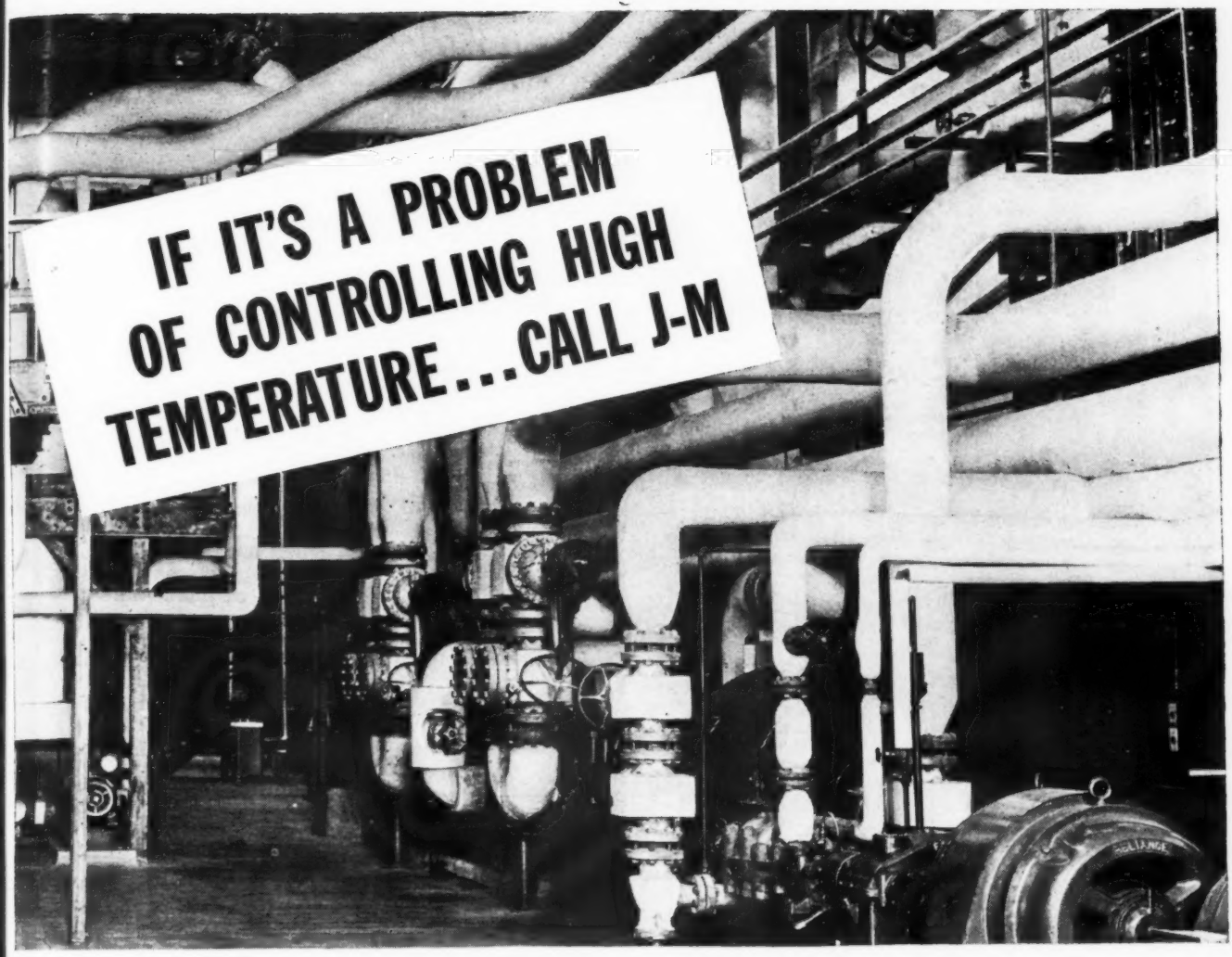
You can find the same condition in plants all over the country—equipment that will almost think—*if the operator will.*

It is easy to see why this is so. Each unit of our mechanical equipment is a product of inventive genius—of one very superior thinker, or a group. Tops in achievement for them is to produce something that does its job faster and better, and that still can be run by us ordinary men. They usually get the "faster and better," but may mistakenly give us too much credit for sense. But, even so, that's *good*. It forces all of us to be on our toes—to be a little better than we actually are.

In that way lies progress. As long as we can stay as close behind our machines, they can't get the edge that will make them Frankensteins—but we get the edge that means victory.

George Edwards

Engineer



There's a J-M Insulation to do the job with utmost efficiency and economy

IT doesn't matter what your heat-control problem may be, there's a J-M Insulation made to solve it. Back of this ability to meet every insulation need is experience . . . 85 years of it . . . in every conceivable type of insulation work. That's why J-M Engineers can design insulation applications for special conditions with utmost speed, thoroughness and economy. Listed here are but a few of the many types of J-M Industrial Insulations.

FOR TEMPERATURES TO 2600° F. J-M Insulating Brick and Insulating Fire Brick are available in 7 types, with temperature limits ranging from 1600° F. to 2600° F. All provide light weight, low conductivity.

FOR TEMPERATURES TO 1900° F. J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″, from 1″ to 4″ thick.

FOR TEMPERATURES TO 700° F. J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, high salvage and resistance to abuse are essential. For temperatures over 700°, used in combination with Superex. It is available in 3-ft. lengths, from 1″ to 3″ thick, for standard pipe sizes.

FOR TEMPERATURES TO 600° F. J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick. Pipe insulation in 3 ft. lengths, from 1″ to 3″ thick, for standard pipe sizes.

For details on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Johns-Manville, 22 East 40th Street, New York, 16, N. Y.

JOHNS-MANVILLE
JM
PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

POWER LINES

Personal notes, items of general interest, the latest from Washington:—all the news that is news in the power field

Promotion of two executives of the Koppers Co, **American Hammered Piston Ring Div,** is announced by Allen W Morton. Koppers vice-president and general manager of the division. **E A Koether,** works manager since 1936, becomes technical assistant to Mr Morton. **Edgar S Freeman, Jr,** assistant sales manager, takes over Mr Koether's duties as works manager.

Four promotions have been announced among **Appalachian Electric Power Co** men in the Bluefield, W. Va., area. **John H Horne,** for several years assistant general foreman, has been promoted to the system's operating department. **C E Archer,** substation design engineer, has been transferred to Switchback, where he will continue with his work and will assume a portion of the duties of general foreman Horne. **Howard Kidd** will assume added responsibilities in connection with the general substation maintenance work, and **Emery Brown** will do likewise in connection with the switchboard and control wiring.

The Office of War Utilities is cooperating in a campaign to flush out of inventory **all idle steel valves** which will not be needed before November 1. Numerous government agencies are engaged in the drive to relieve a critical shortage of valves for the high octane gasoline, rubber and shipbuilding programs. OWU has mailed **Form WPB-2884** to all utilities, asking that they list on it all surplus valves and indicate whether they will sell the valves to the government. Those valves sold now which must be replaced later are to be listed with their replacement dates so that they can be scheduled with the valve makers. **Valves needed** range in size from ¼ in. up. Transfer of valves between federal agencies will be made on mutually acceptable terms. Surplus valves of private holders will be purchased by Metals Reserve Corp at market prices and resold to manufacturers, with the transportation costs borne by Metals Reserve. The program is being directed by **WPB's Redistribution Division.**

Because of the difficulty of obtaining newsworthy scrap photographs, the **Business Press Industrial Scrap Com-**

(*Continued on page* 190)

SHORT WAR OR LONG—YOUR CHOICE

As we go to press we receive from WPB chairman Donald Nelson a warning and a challenge to POWER readers. Despite headlined victories all is not well with our War—not by a long shot.

The home front isn't keeping up with the military front. If something isn't done about it at once, there will be trouble ahead, particularly for the soldiers and sailors who will have to fight longer and more dangerously.

Two things have happened. Our fighters are moving faster than we figured: home-front production is falling behind schedule. In short, the War consumes material faster than schedule while we produce slower than schedule.

There are only two ways to balance the account. We can postpone big planned campaigns in Europe and Asia, giving the enemy a breather and a chance to kill more of our men. Or we can roll up our sleeves, bring production up to the mark, and shorten the War by many months.

For that is a fact—it lies in our power, in the hands of us on the home front, to fix the length of the War and the size of the casualty list. If we can keep pace with the needs of our fighting forces, if we can meet the expanded production schedules, we will play our part in literally blasting the War to an early end.

Because the power engineers of America stand at the very heart of the productive machine, we ask you to do these two things:

First: Make sure your own power services to production meet and even exceed all demands.

Second: Tell your coworkers, particularly the men on the production line, what's wrong, what's at stake, and what to do about it.

Phil Swain

George H Gibson, 67, inventor and head of the New York industrial advertising firm that bears his name, died July 28 at Montclair, N. J. after a brief illness.

Widely known as a writer on technical and engineering subjects, Mr Gibson was an inventive pioneer in the power field. Among his inventions were a high-speed fan, a primary battery, a chemical proportioner, a V-notch meter, a filter, and an improved deaerator. He held basic and dominating patents in the metering control of combustion. His patents numbered more than one hundred. For such achievements he was cited as a modern pioneer by the awards committee of the National Association of Manufacturers.

George H Gibson

Born in Michigan, and an engineering graduate of the University of Michigan, Mr Gibson worked in his early years for Westinghouse, Engineering News, B F Sturtevant and International Steam Pump Company. He organized the Geo H Gibson Co in 1905.

He was a member of the American Society of Mechanical Engineers, Director of Advertising and Publicity for DeLaval Steam Turbine Co. and, as an ardent sailor and yachtsman, held membership in the Northport Yacht Club, the United States Power Squadron and the Navigators' Club.

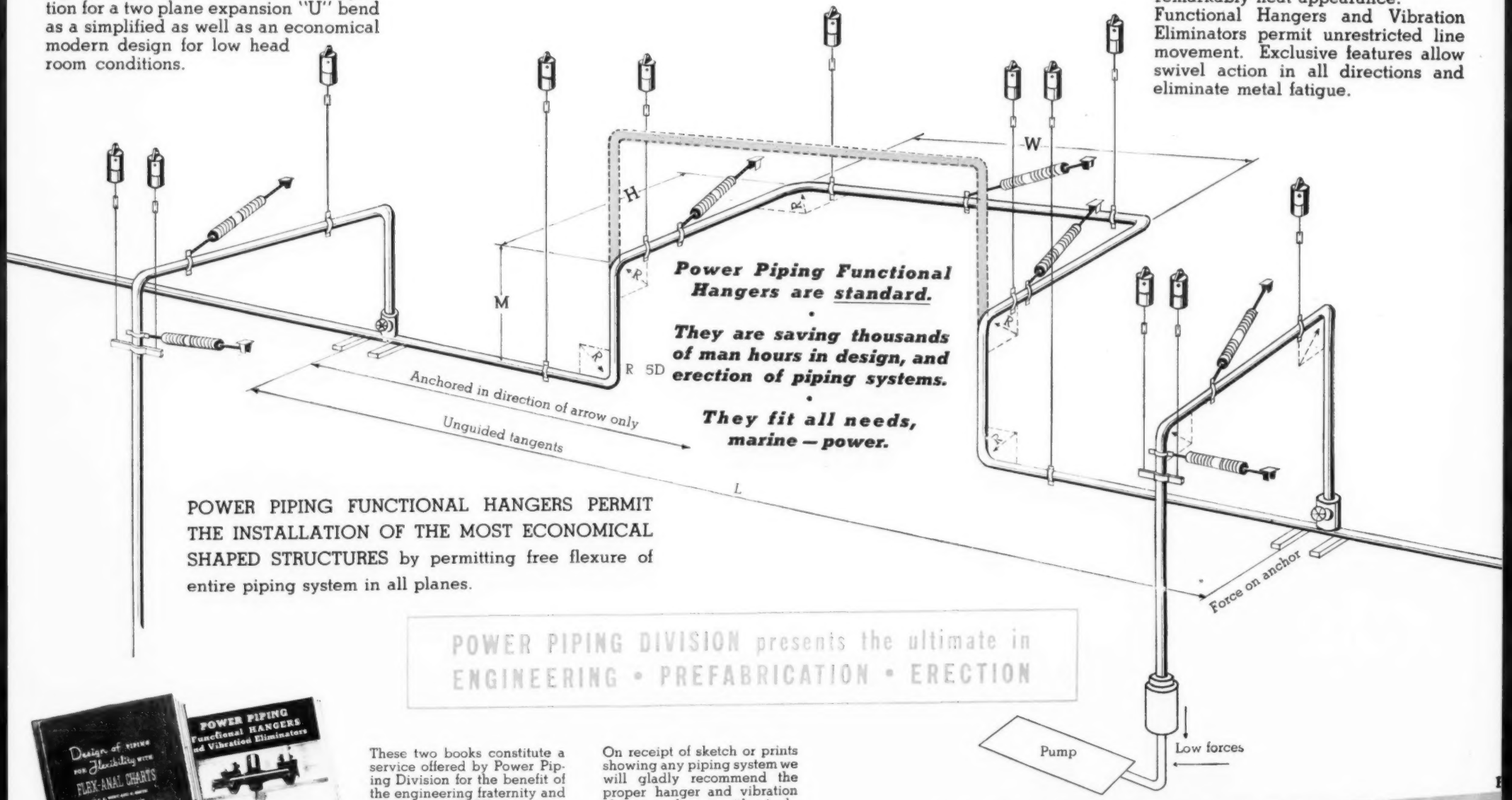
POWER PIPING SERVICE IS YEARS IN ADVANCE

POWER PIPING SERVICE IS YEARS IN ADVANCE

One example of "Scientific Approach to Piping Problems," illustrates a suggestion for a two plane expansion "U" bend as a simplified as well as an economical modern design for low head room conditions.

Spring assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a remarkably neat appearance.

Functional Hangers and Vibration Eliminators permit unrestricted line movement. Exclusive features allow swivel action in all directions and eliminate metal fatigue.



Power Piping Functional Hangers are standard.

•

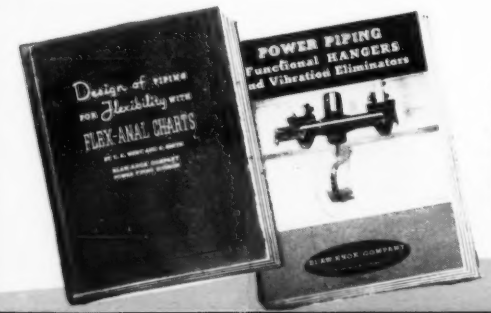
They are saving thousands of man hours in design, and erection of piping systems.

•

They fit all needs, marine — power.

POWER PIPING FUNCTIONAL HANGERS PERMIT THE INSTALLATION OF THE MOST ECONOMICAL SHAPED STRUCTURES by permitting free flexure of entire piping system in all planes.

POWER PIPING DIVISION presents the ultimate in
ENGINEERING • PREFABRICATION • ERECTION



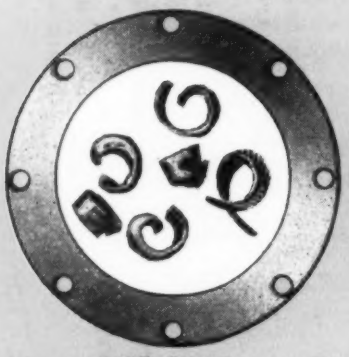
These two books constitute a service offered by Power Piping Division for the benefit of the engineering fraternity and will be sent FREE to any engineer requesting them on his business letterhead.

On receipt of sketch or prints showing any piping system we will gladly recommend the proper hanger and vibration eliminator layout without obligation.

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1526 PENNSYLVANIA AVE., PITTSBURGH, PA.

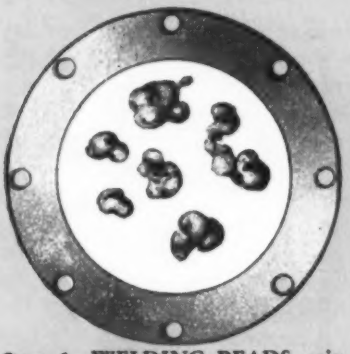
Prevent Valve Failure

Case 1. PIPE SCALE clogs valves. *Prevention:* Blow out or flush pipe thoroughly.



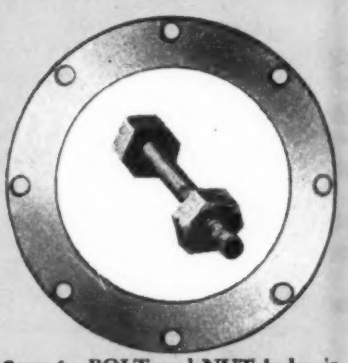
Case 2. PIPE CHIPS ruin valve seats. *Prevention:* Clean threads before connecting pipe.

Case 3. JOINT COMPOUND clogs valves. *Prevention:* Put it on pipe threads only.



Case 4. WELDING BEADS ruin valve seats, prevent closing. *Prevention:* Blow out or flush pipe.

Case 5. NAILS jam seats in gate valve. *Prevention:* Instruct workmen to clean lines.



Case 6. BOLT and NUT lodge in gate valve seat. *Prevention:* Instruct workmen to be careful.

JENKINS VALVES

before it starts!

SAVE VALVES...Keep War Production Moving...See that Pipe Lines are CLEAN before they are closed

Look over this rogues' gallery of valve saboteurs. Records show that every one of them has been caught in a pipeline . . . left there during installation or repair work. All have caused crippling shutdowns . . . some have ruined valves beyond repair.

To guard against the constant threat of damage by these valve enemies, workmen must be taught to look into, and *through* every unit of a system before it is connected up. As a further precaution, thorough flushing or blowing out before the system is put into service is recommended.

Time lost in production slowdowns today may mean lives lost on the battlefield, because the flow of vital war materiel to our fighting forces is interrupted.

Slowdowns due to valve failure can be prevented, waste of critical valve metals greatly reduced, by effective valve conservation. See that your valves get frequent, systematic inspection. Repair or renew worn parts before a valve destroys itself. When valves must be replaced, have the new valves selected and installed by experienced men. Above all, train new workers to operate and maintain valves properly.

Jenkins Engineers will provide any assistance you need for improving your system of valve conservation, upon receipt of details of present valve problems.

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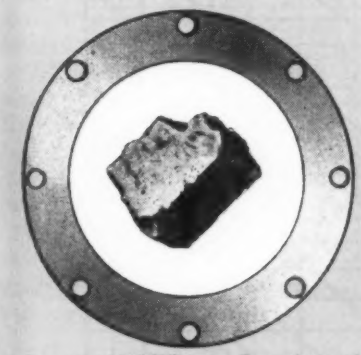
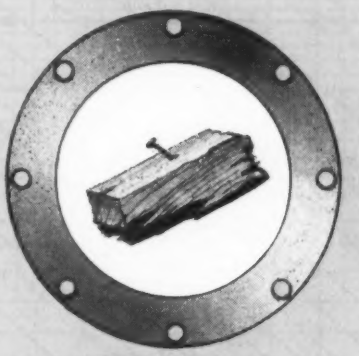
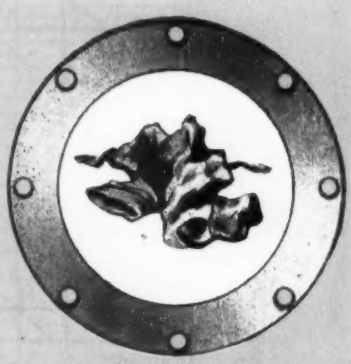


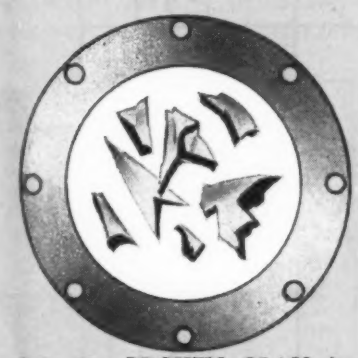
Case 7. BRICK stops flow through line. *Prevention:* Look before closing line.



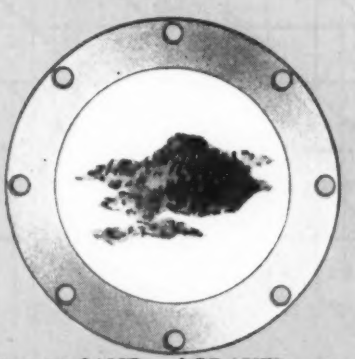
Case 8. JOIST END prevent check valve closing. *Prevention:* See that new lines are clear.



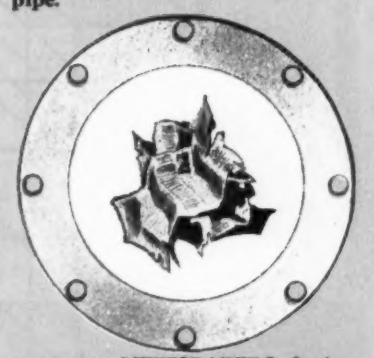
Case 9. OVERALLS stop action of swing check valve. *Prevention:* Instruct workmen to look through pipe.



Case 10. BROKEN GLASS jar fragment ruin valve seat. *Prevention:* Thorough inspection of lines.



Case 11. SAND and GRAVEL wear out valve parts. *Prevention:* Flush out lines.



Case 12. NEWSPAPERS foul a check valve. *Prevention:* Make sure lines are clear.

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Temperature Rise in Boiler-Feed Pumps

► DIFFERENCE BETWEEN BRAKE HP consumed and the water hp developed in a pump is practically all turned into heat and carried away by the water. Rule-of-thumb practice sets temperature-rise limit at about 15 F. This chart enables direct calculation of temperature rise from total head and efficiency values.

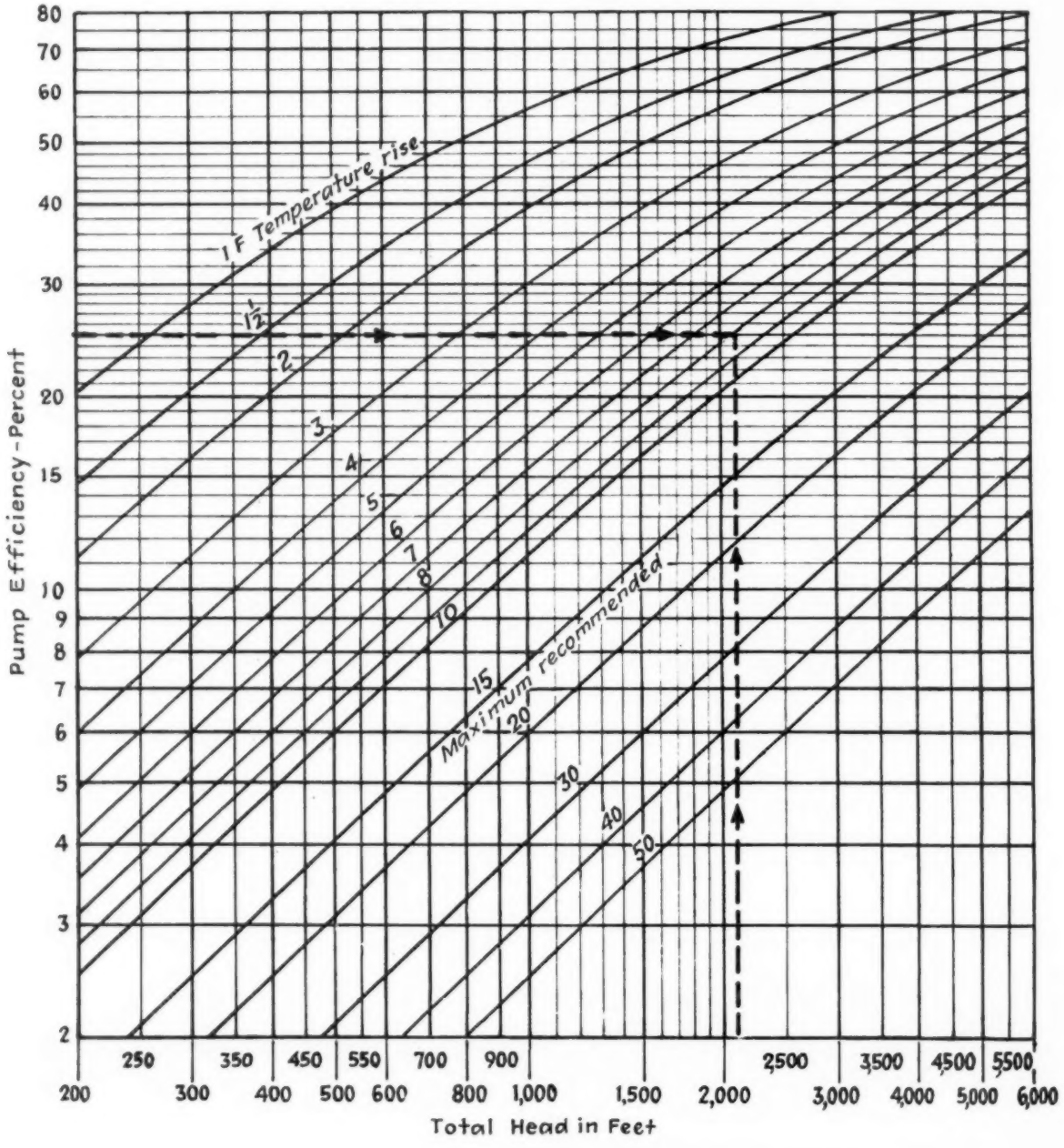
For a given flow, determine total head and efficiency from head-capacity curve. For the pump performance shown in Fig. 1, page 103 of this issue, at 100 gpm flow, head is 2160 ft and efficiency 25%. Temperature rise is 8.3 F.

If pump is fitted with a balancing device, use corrected efficiency such that:

$$\text{Corr Eff} = \text{Pump Eff}\left(\frac{Q + Q_d}{Q}\right)$$

where Q is capacity at pump discharge and Q_d is flow through leakoff.

By Igor Karassik and Roy Carter



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DUST RECOVERY SYSTEMS

BUY WAR BONDS AND MAKE THE AXIS BITE THE DUST

Diesel Fundamentals

(*Continued from page* 81)

finding expression in lower specific fuel consumption. Four lb of diesel fuel produces as much power in a diesel cylinder as 5 lb in a gasoline engine. This reduces the power handicap of the diesel to $5/4 \times 2/3 = 10/12$, which means that if the power output of a gasoline engine is taken as 100%, the power output of the diesel is 84%, again provided that size, speed and general design are the same.

However, these factors are not the same and for the past 25 years designers have concentrated on increasing power output for a given size and weight. Let's see how they succeeded.

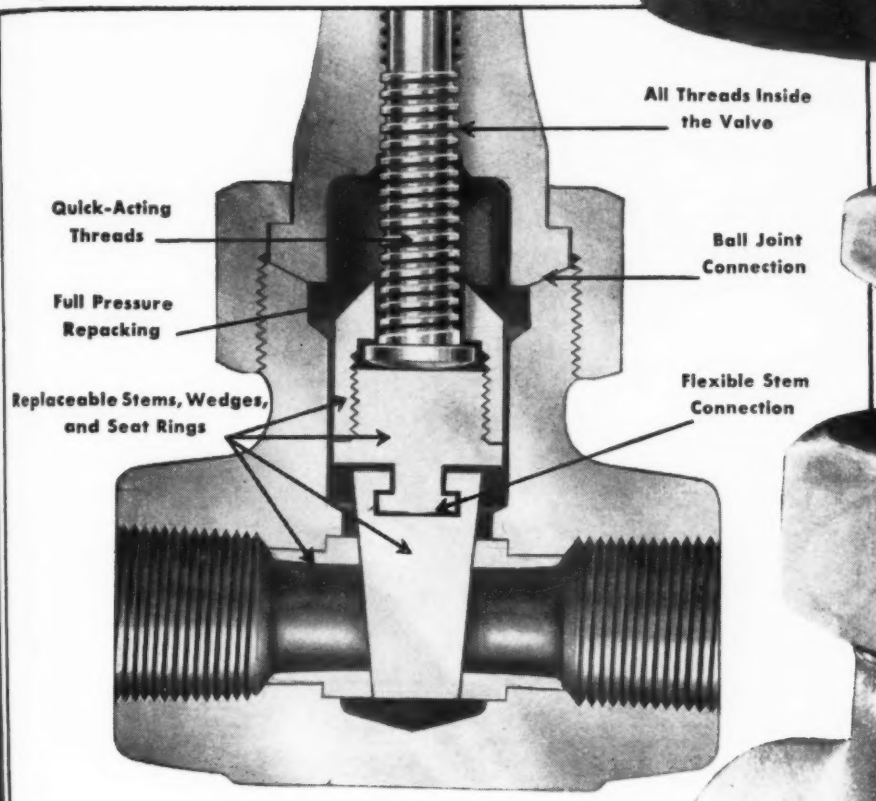
Because excess air represents one cause of lower diesel power output, it is natural that considerable effort has been exerted to reduce this margin of excess air. These efforts achieved some success but the path was not an unbroken climb, rather one marked by ups and downs.

Early Diesel Designs

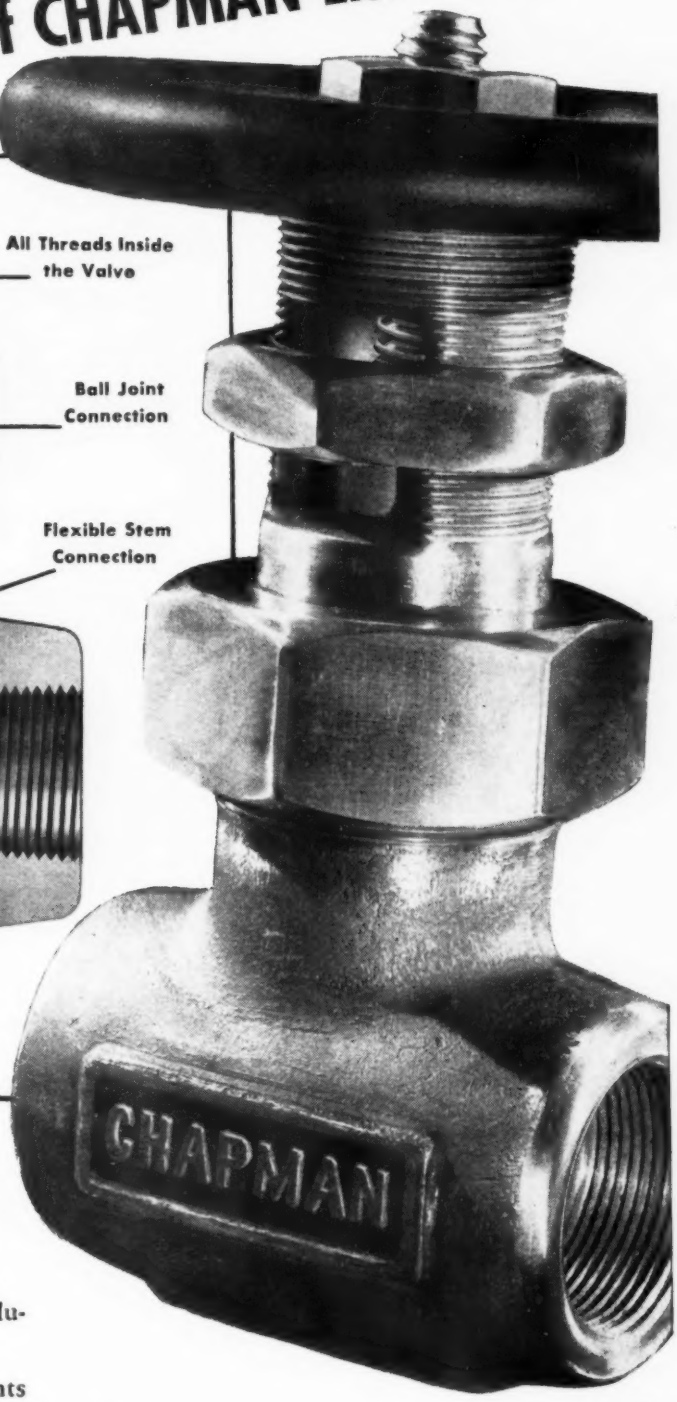
The German engineer, Dr Rudolph Diesel, invented the engine that bears his name in 1893 and the first successful engine, a 25-hp unit, was completed by him in 1897. The first diesel to operate in commercial service was built in this country by the Busch-Sulzer Bros Diesel Engine Co in 1898. These machines, as well as thousands that followed in the next 25 years, were of the air-injection type. High-pressure air produced by a compressor blasted the fuel oil into the cylinder. While the air-injection engine was a bulky affair, weighing a couple of hundred pounds per horsepower, the high-pressure air proved an effective mixer and excess air ran relatively low.

In 1910, the Englishman McKechnie developed the airless- or solid-injection engine which has become the dominant type in the last 30 years. This design eliminated the bulky and troublesome air compressor, the fuel being injected under pressure (2000-5000 psi) produced by a small high-precision fuel-injection pump. Dispersion troubles were, however, aggravated. The tiny spray or sprays failed to mix intimately with cylinder air, making a smoky exhaust that could only be cleared by increasing excess air. This cut down power output. As late as the 30's our Navy would not consider the solid-injection engine for submarines where high power output was essential but smoky exhaus-

Here's the INSIDE STRAIGHT on the Extra-Long Life of CHAPMAN List 960



INSIDE SCREW RISING STEM



These six features of Chapman design add up to longer life for List 960 than for any comparable small valve. Specially important are the tough seats and plugs which . . . if *your* service is especially severe . . . may even be *super-hardened* by an exclusive Chapman process.

This means that List 960 is the No. 1 valve for plants that want to get rid of all the usual small-valve troubles *for the duration.* Chapman makes this tough forged-steel valve in sizes from ¼" to 2" . . . for all pressures up to 800 lb. at 750° F, or 1500 lb. cold working pressure. Standardize on List 960 for all *your* small steam, water, gas, oil, and air lines.

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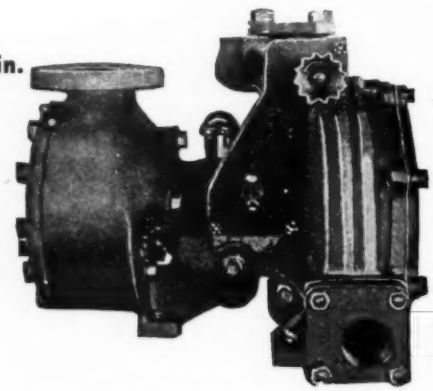

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could not be tolerated.

Gradual improvement led to modern injectors built to tolerances closer than those for almost any other mechanical device. These produce finely atomized sprays carefully distributed over the air space. Combustion chambers are shaped to fit the spray. By these means, mixing was improved and the excess-air margin reduced.

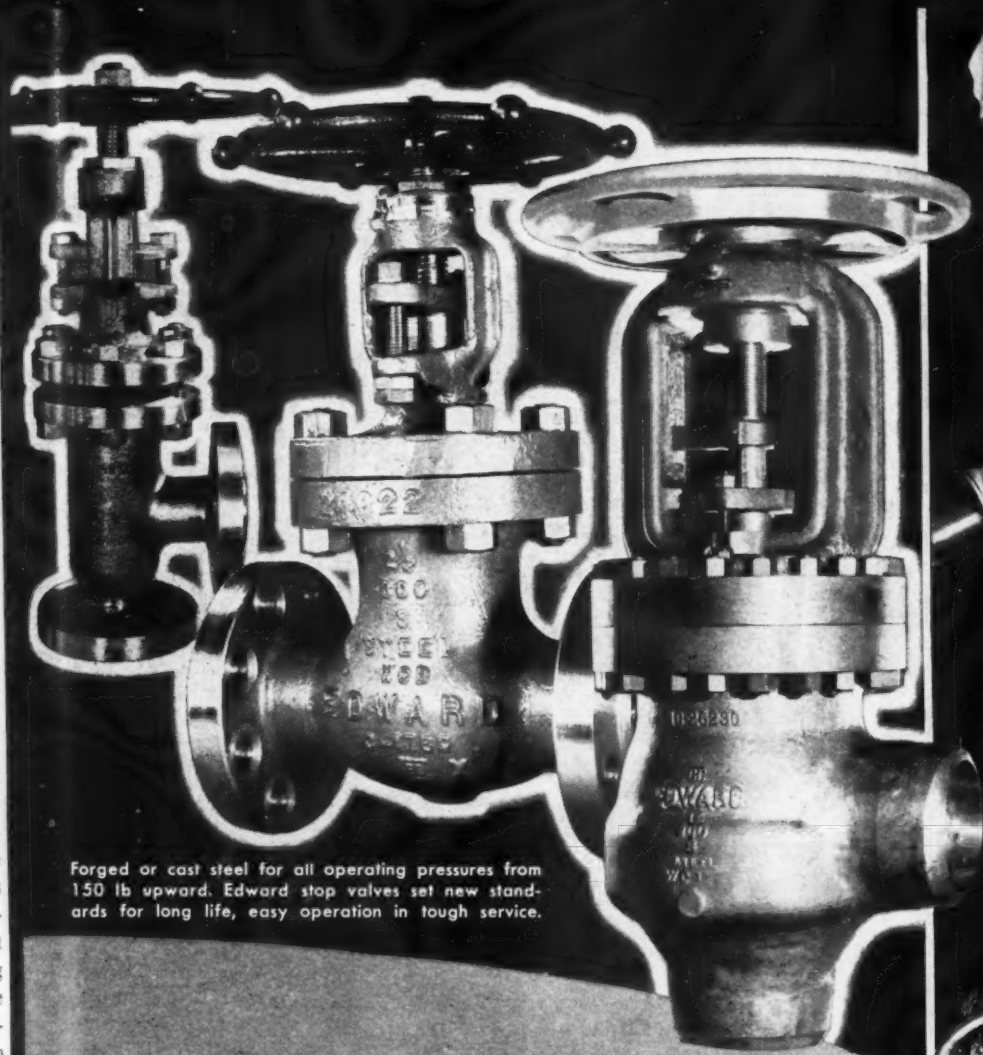
Fuel Spray Problems

Nevertheless, complete success eluded the diesel designers. The solid-injection diesel spray somewhat resembles that of a gun-type domestic oil burner with, however, a significant difference. The oil burner sprays into atmospheric air while the diesel spray has to penetrate dense 500-psi air. It is not difficult to produce a finely atomized and well dispersed spray in atmospheric air but it is next to impossible in highly compressed air. Unless the spray is subdivided into six, eight, or more small sprays it will not cover the entire combustion chamber. Unless forced in under several thousand psi pressure, the oil will not break up into tiny globules of about 1/1000 in. in diameter, as required. Large globules or a solid jet will not ignite any better than a log of timber without kindling wood. The fine mist in the spray forms the "kindling wood" of the diesel engine, but to get it the oil must be shot in with a velocity of a bullet, over 500 miles per hr. High spray velocity in a multiple spray results in extremely small spray holes, of the order of 1/100 in. in diameter.

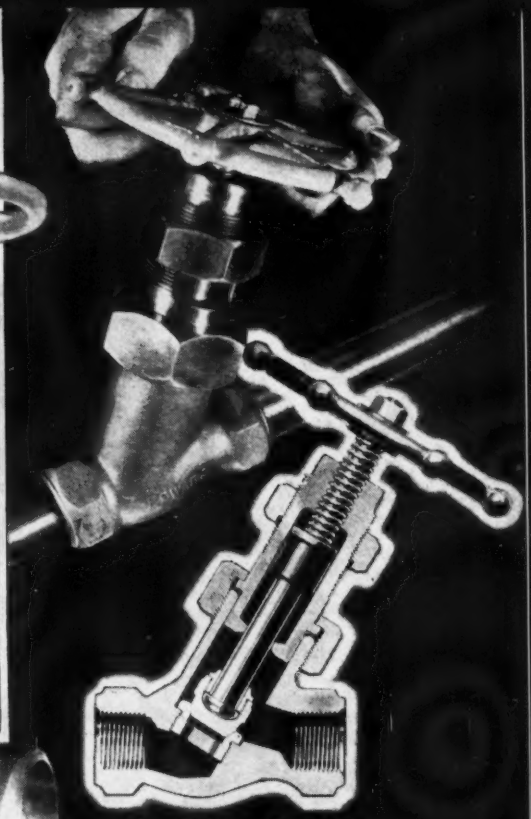
Lack of Penetration

With extremely fine sprays we run into another trouble—lack of penetration. In atmospheric air a high-velocity jet reaches several yards easily, but the 500-psi air is more like a rock and the spray cannot penetrate more than a few inches. In an incredibly short time the oil globules that start out like rockets stop dead and fall down like shot birds, devoid of energy. No further increase of injection pressure can improve the penetrative power of the spray. On the contrary, upping the injection pressure makes the penetration less because the globule size becomes so small that penetrating power vanishes. The plain fact is that fine atomization and deep penetration are contradictory requirements. Yet for good mixing of fuel and air we need both, so must put up with a compromise.

Another approach to obtain the desired objective, good mixing, lies in the use of air turbulence. Instead of making the spray go into the air, the Eng-



Forged or cast steel for all operating pressures from 150 lb upward. Edward stop valves set new standards for long life, easy operation in tough service.



Edward's famous Fig. 2688 illustrates full area body, streamlined flow passages and rugged construction of entire Edward forged steel stop valve line.

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DESIGNED for maximum job and part interchangeability, Edward STOP valves make it possible to greatly reduce your inventories of spare valves and parts.

Cast or forged steel, globe or angle, ¼ in. to 16 in., 150 lb to 1500 lb and up operating pressures—the entire Edward stop valve line has many features in common. Such important things as streamlined flow for low pressure drop, sure closing action, fully guided disks, and laboratory tested materials for long service on the toughest jobs.

But important as all these are, don't undervalue the advantages of Edward interchangeability. Particularly these days when your storeroom shelves carry fewer and fewer parts.

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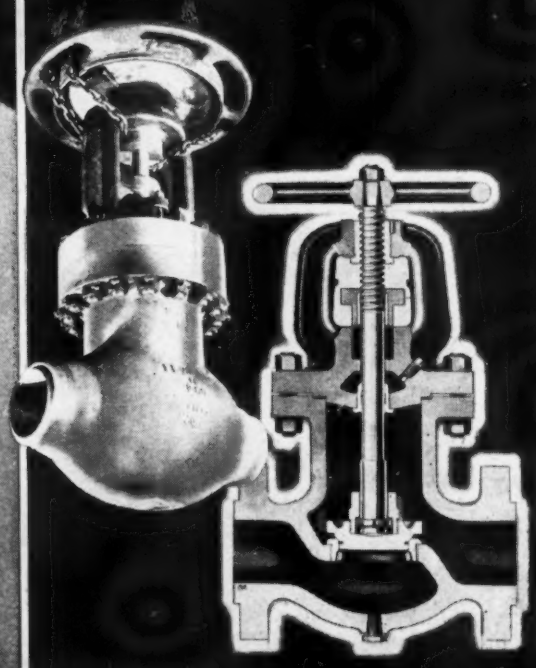

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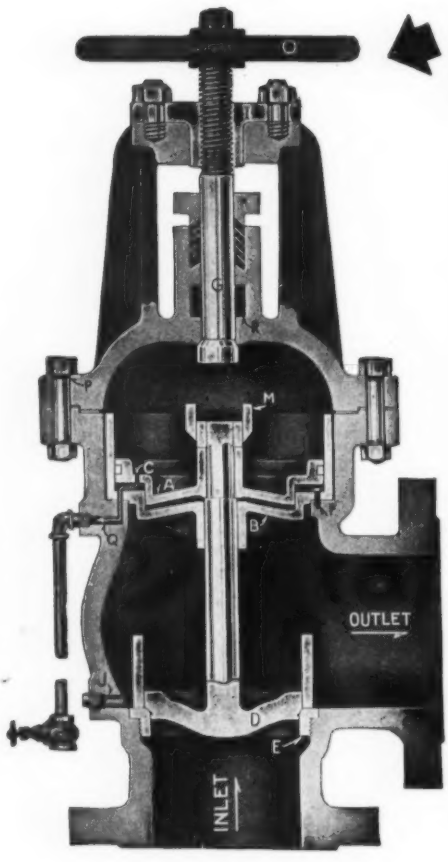

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lishman Ackroyd, and others, conceived the idea of making the air go to the spray. Designers have since devised a variety of means to impart to the combustion air a motion that would enable it to seek out the oil particles rather than wait passively for them.

One way involves inducing the air to perform a rotary motion in the cylinder by admitting it tangentially. Another is a separate swirl chamber into which the piston squeezes the air, which swirls around while the fuel is injected. Still another answer lies in starting out with a preliminary explosion in a "precombustion chamber," depending on the ensuing agitation to mix the cylinder air with the fuel. A similar effect is obtained by allowing some of the combustion air to accumulate in an internal air-storage cell and blow out from it at the opportune moment to feed the combustion like the oxygen jet of an oxy-acetylene burner.

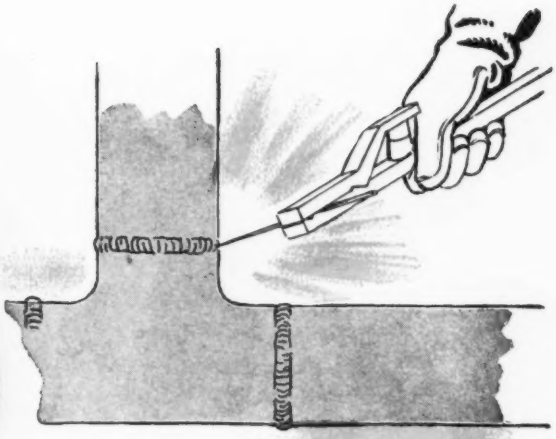
Thus in recent years the classical open-chamber engine of Diesel gained such companions as the turbulence-chamber, the precombustion chamber, the air-cell and the energy-cell engines, each contributing in its own way to the ultimate goal of the diesel engineer—perfect mixing of air and fuel in the shortest possible time. The illustrations show typical examples of various combustion chamber designs.

Excess Air

Still excess air cannot be dispensed with. In some designs it can be cut to about 25% if we are willing to pay the price for it. The price is increased fuel consumption because of higher mechanical and thermal losses. Any scheme that employs high turbulence for mixing air with fuel must provide the high-velocity air, which takes power. The turbulent air also loses more heat to the cylinder walls and leaves less for useful work. As a result, "divided-chamber" engines may show about 10% higher fuel consumption and the total power output for a given cylinder size runs about the same as with the classical open chamber. Nevertheless, the divided-chamber engine proves popular in small sizes because of its better speed flexibility and because it avoids excessively small nozzle orifices. Coarser spray from a single-hole nozzle proves adequate when air turbulence performs the major duty of mixing.

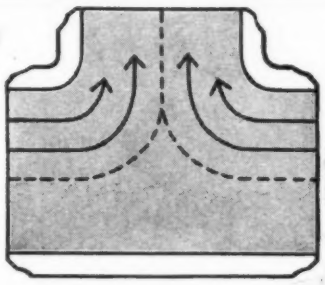
Editor's Note: In a second article, Dr. Schweitzer will show how diesel designers have endeavored to increase engine output and reduce weight by increasing rotative speed, developing the 2-stroke cycle, and supercharging.

How TUBE-TURN welding tees improve piping construction



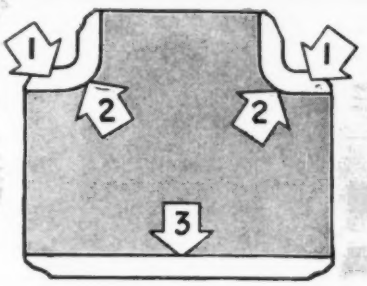
LONGER OUTLETS SPEED WELDING

More room for easier manipulation of rod means faster welding and better, sounder welds.



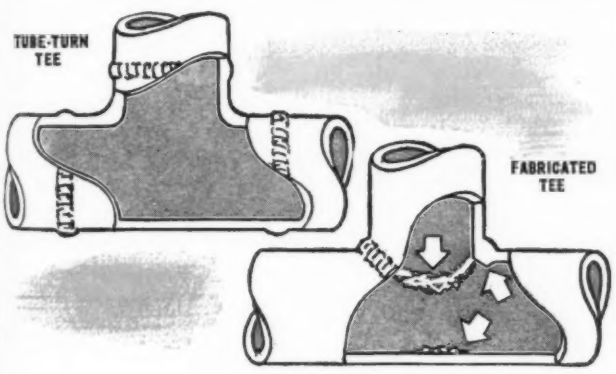
SMOOTH FLOW, LESS PRESSURE LOSS

Smooth inner walls assure even flow and reduce wear. Rounded inside crotch reduces pressure loss.



EXTRA STRENGTH AT STRAIN POINTS

Added thickness at top of run (1), crotch (2) and bottom (3) strengthens points of highest stress.



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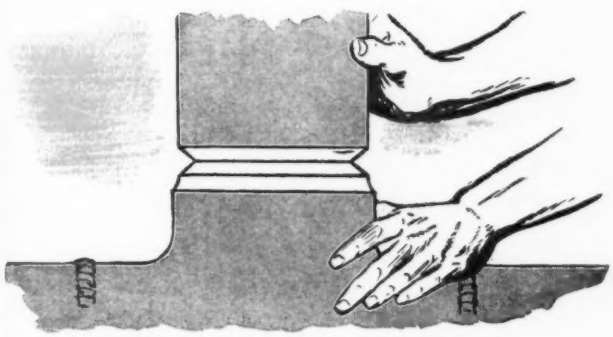

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NO. 8 OF A SERIES
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Believe it or not, mister, a well-lubricated load chain will outlast a dry chain **fifteen times.** That sounds incredible, but it's true. You see, every link has a bearing area where it meets its neighboring links. Unless there is a protecting film of oil at these points, the friction will cause undue wear. Another place where the protection of oil is needed is when the chain comes in contact with the load wheel.

. . . But let's go back to the chain itself. A dry chain wears prematurely—lengthens itself out of pitch. And a chain out of pitch cannot seat itself properly in the wheel sockets. Another vicious result of wear.

. . . So please—now that all steel products are critical—lubricate your load chain regularly and make it last; twice, five times, ten times, yes—**fifteen times** as long.

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ACCO *In Business for Your Safety*

Pneumatic Stokers

(*Continued from page* 87)

A panel conveniently located in the boiler firing aisle carries the control equipment. The original full-floating combustion control, used for the oil burners, was redesigned to suit the coal-burning equipment. A regulator actuated by steam pressure adjusts rate of coal feed, combustion-air supply and furnace pressure. To control coal feed, the regulator action is transmitted to a shaft and linkage on the boiler-room floor which connects, in turn, to a counterweighted jackshaft above the stoker motors in the pit (see Photos 1 and 3). Vertical links tie the jackshaft to the pivoted bases of the feed-screw motors. Changes in steam pressure thus raise or lower the motor bases and, in turn, increase or decrease the distance between the pulleys of the Reeves variable-speed drive. This results in a change in pitch diameter of one sheave, which is split and spring loaded, and so produces the desired variation in feed-screw speed.

A "timetactor" supplements the pressure control, its function being to bring in the stokers at preset time intervals, to keep the fire alive when desired steam pressure is reached and the demand for steam has been satisfied or to keep the fire alive during standby periods, such as week-ends or holidays, when there is no demand for steam but the boilers must be kept in readiness for fire or other emergencies.

Stoker Starters

Either the pressure control or the timetactor will start the stoker on their respective demands through magnetic switches, one for each motor. Overload protection is also incorporated in each of the linestarters. Disconnect switches for each motor are used when it is desired to cut out one or more motors for cleaning, for banking fires, or for the protection of those working on the units.

In addition to the above electrical control equipment, it proved necessary to install vacuum-tube delayed-action timers to permit the hot-gas fan to continue operation after the feed-screw motor shuts down. The unusually high lift of 32 ft required this arrangement. The vacuum-tube relay offers a high degree of reliability, there being no moving parts to wear out.

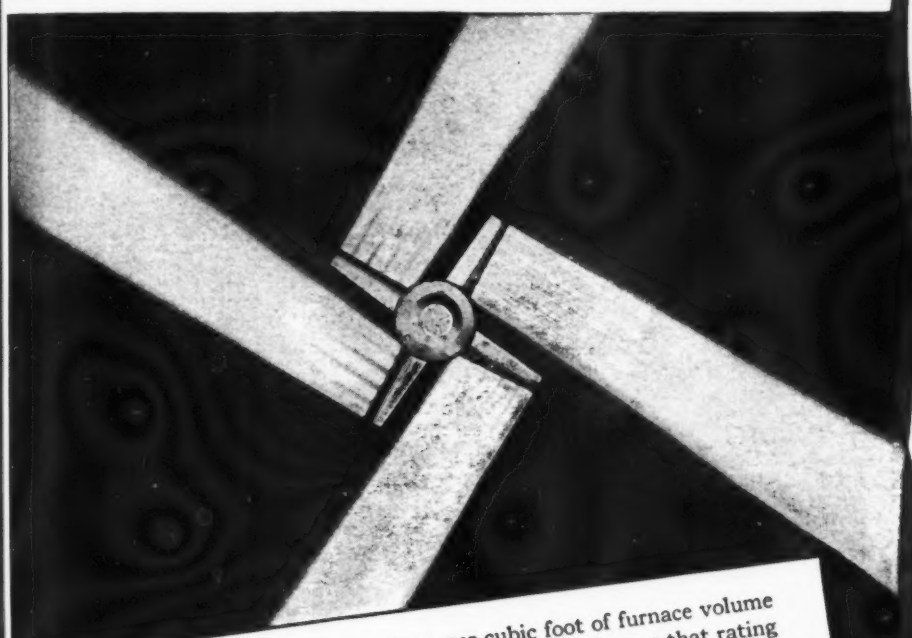
Much of the credit for the good layout and fine workmanship on the control panel and associated electrical devices goes to Hunt-Rankin's chief electrician, J L Alberghine.

HOW TO INCREASE THRU-PUT BY ONE SIMPLE CHANGE

Pinwheel Action STEPS UP RATINGS

Installing Coppus-Dennis FANMIX Gas Burners permits increased heat release per cubic foot of furnace volume

"Pinwheel Action" combines gas with air in a properly proportioned mixture. Gas escaping from orifices in the blades, rotates the fan, causing in-take of air at right angles to path of gas. The energy in gas under pressure is utilized to perform work by mechanically mixing and proportioning the gas with just the proper amount of air, thus eliminating from the furnace the necessity of serving as a mixing chamber as well as combustion space.



You get so much more heat release per cubic foot of furnace volume when you change to Coppus-Dennis FANMIX Gas Burner that rating of boilers (or other equipment) can be increased far beyond the limit allowed by present burners.

New Principle in Gas Burners Gives EXTRA Values on Top of GREATER HEAT RELEASE

Even Temperature: complete combustion without impingement—no drifting "hot spots". *No Cracking of Wet Gas:* driver arms stay below "cracking" temperature. *On New Installations:* smaller combustion space, less stack required, no forced draft equipment needed.

Write for free Booklet 410-3 which explains *other* savings you make with Coppus-Dennis FANMIX Gas Burner — a Coppus "Blue Ribbon" Product. Address: Coppus Engineering Corporation, 309 Park Avenue, Worcester, Massachusetts.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

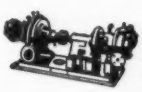
(Check the ones you want)

☐ Coppus Unit Air Filters. For industrial ventilating and air conditioning systems. Bulletin F-320-5.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.



☐ Coppus Steam Turbines. 6 sizes (and prices) from 150 H. P. down to fractional. Bulletin 135-9.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

Name.....

Company.....

Address.....

City.....State.....

Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in Sweets' Catalog.

COPPUS

COPPUS BLUE RIBBON PRODUCTS DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

Arteries OF STEEL

FASHIONED FOR INDUSTRY

The vital needs of war industries for fabricated piping in all its multi-phases are being fulfilled constantly in Associated shops. Time is usually a basic factor. On this premise, Associated services become increasingly comprehensive. For example, high pressure, high temperature alloy fabrications are completed without looking to secondary sources for flange requirements. This is possible because Associated manufactures flanges (2500 lb. carbon moly ring joint flanges on fabrications pictured above). Time saved by this unusual auxiliary service alone is worth — how much?

Whatever your power fabrication requirements, let Associated do the work

WAR PRODUCTION . . . This company is engaged in high priority war production, proud of its responsibilities and fulfilling them to the letter.

ASSOCIATED PIPING & ENGINEERING CO., INC.
2332 EAST 38TH STREET
LOS ANGELES, CALIFORNIA

Operation of these stoker-fired units indicates an overall efficiency of 73%, with 13.5% CO_2, and 530-F exit-gas temperature. At operating pressure of 175 psi gage, the evaporation averages 10.8 lb per lb of coal. Fuel used is 1¼ in. Pocahontas nut and slack; an analysis shows 14,500 Btu per lb. A Ford speedometer connected to the gear case through a set of cut gears measures coal consumption. With a step-up ratio of 3:1, 20 miles on the speedometer represents one ton of coal.

Besides furnishing steam to its own plant, the Hunt-Rankin Leather Co sells 38,000 lb of steam per month to the Tannin Corp and 100,000 to the Lewis & Hansen Corp wool-reclaiming plant. This puts many unexpected demands on the Hunt-Rankin boiler plant and steam flow varies from normal boiler rating to 195% of normal. Despite severe load swings, the controls maintain desired pressure within close limits.

The entire project was completed under the direct supervision of E F Pratt, master mechanic, Harry Huggins, chief engineer, and Harry Dengate, supervising engineer for Iron Fireman Corp.

Reciprocating Engines

(*Continued from page* 88)

the engines just above and forward of the controls. Duplicate speed indicators are mounted in the pilot house.

Double-seat steam-inlet poppet valves of forged alloy steel have one seat telescopically mounted to compensate for expansion. These valves, ground-in cold, will remain steam tight throughout their life without regrinding.

Small single-seat compression-relieving exhaust valves are actuated from the main cam box and are effective only during maneuvering. They also serve as drip valves.

Connecting-rod bolts and nuts, as well as piston-rod nuts, have a special locking device. Cylinders are usually enclosed in a steel jacket fitted with removable doors to allow accessibility to tappet adjustments. Cast-steel thrust-bearing saddles are bolted to the rear end of the bed plates with Kingsbury 2-shoe thrust bearings.

Mounted on the stern end of the bearing frame, a 5x5-in. barring-over engine is connected by a chain drive to a roller-bearing-mounted worm and wheel which can be engaged when it is desired to bar the engine. In case of condenser vacuum failure, volumetric clearances in the main cylinders are increased by opening hand-operated clearance pockets, permitting operation

"No ABSENTEEISM for this couple"

● Plants that trapped their unit heaters with Anderson Super-Silvertop Steam Traps find that today there is no absenteeism for their heaters or their traps—both are on the job every day. Super-Silvertop keeps the unit heater bone dry and free of air, assuring a maximum heat output. Unit heaters delivering 100% are saving on fuel, which in these times is highly important. Many tests have proved that heat output of unit heaters can be increased 25% by replacing inefficient traps with Super-Silvertop. Write today for a copy of the book entitled, "How To Choose a Steam Trap," giving complete information on trapping unit heaters with Anderson Super-Silvertops.

THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • CLEVELAND, OHIO

Super-Silvertop
STEAM TRAPS

Make Good Piping Better

with

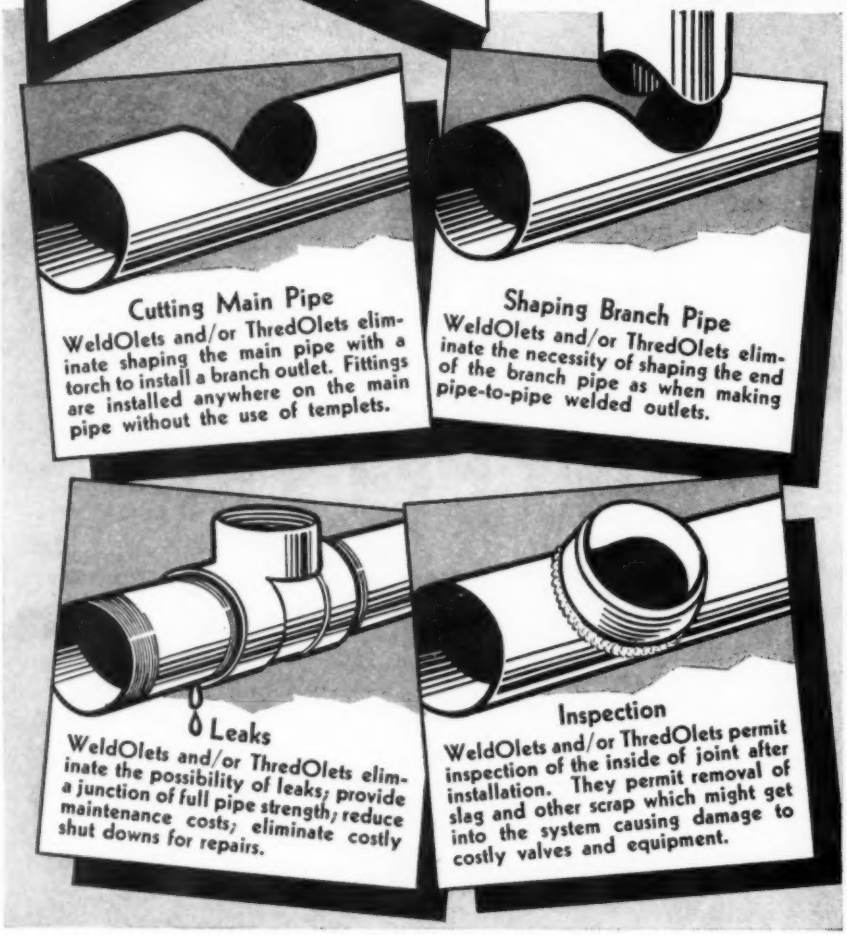
WELDOLETS • THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.



Cutting Main Pipe
WeldOlets and/or ThredOlets eliminate shaping the main pipe with a torch to install a branch outlet. Fittings are installed anywhere on the main pipe without the use of templets.

Shaping Branch Pipe
WeldOlets and/or ThredOlets eliminate the necessity of shaping the end of the branch pipe as when making pipe-to-pipe welded outlets.

Leaks
WeldOlets and/or ThredOlets eliminate the possibility of leaks; provide a junction of full pipe strength; reduce maintenance costs; eliminate costly shut downs for repairs.

Inspection
WeldOlets and/or ThredOlets permit inspection of the inside of joint after installation. They permit removal of slag and other scrap which might get into the system causing damage to costly valves and equipment.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to prefabricated or "on-the-job" assemblies. Because of their patented, funnel-shaped intake aperture they improve flow conditions. Carried in stock for all standard pipe sizes up to 12" in size-to-size or reducing sizes—and can be furnished on special order in sizes up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for a copy today.

Forged Fittings Division
Bonney Forge & Tool Works, Allentown, Pa.

Star Awarded July 10, 1943

WELDOLETS • THREDOLETS

TRADE MARKS - REG. U.S. PAT. OFF.

Welded Outlets for Every Piping System

of the engine with atmospheric exhaust but at reduced capacity.

Because of the smooth torque obtained from a set of five high-pressure cylinders, giving ten impulses per revolution, propeller shafting is of the same diameter as installed on turbine-electric ships of similar horsepower.

One ferry, equipped with a small unaflow engine, has shown increased economy over a conventionally powered boat on the same run amounting to 40% less coal and 38% less water when developing 16% more horsepower.

Although designed primarily for marine propulsion, these engines have given an excellent account of themselves as centrifugal-pump drives aboard floating suction dredges of the U. S. Army Engineer Corps.

Compressor Protection

(*Continued from page* 105)

can provide protection for a steam-driven compressor in connection with the overspeed shutdown device.

Excessive-temperature shutdown. Under normal conditions, a compressor seldom requires protection against possible excessive discharge temperature other than the operating crew's usual inspection and maintenance. However, in many abnormal operating or pressure conditions, protection from excessive discharge temperatures is desirable. When a compressor is visited by an attendant at infrequent intervals, a thermostat in the discharge line can shut it down. On a motor-driven compressor, this device opens the control circuit of the driving motor, and on a gas-engine compressor, it may ground the ignition or operate to close the valve in the gas supply line. On a steam-driven compressor, the thermostat can function through the overspeed shutdown, if one is provided.

Thermal Shutdown

Main bearing protection. When motor-driven compressors do not have a full-time attendant, the main compressor bearings can be protected by thermal shutdown devices. These open the control circuit and shut the compressor down if temperature of the bearings becomes excessive. This device may be installed regardless of the type of oiling system.

Discharge thermometers. On the discharge of each compressor cylinder, thermometers warn of excessive tem-

"What can BETZ do for US?"

Here is our answer... We are a nationwide organization of chemical engineers, devoting all of our efforts to the solution of water conditioning problems relative to boiler feed water... cooling water... process water... domestic water ... municipal water... air conditioning systems ... Diesel engine systems... refrigeration... industrial waste disposal and sewage disposal. Our service is complete for all plants small or large, old or new, with individual recommendations made for each plant.

For those plants already in operation we offer comprehensive studies of water problems, leading to most efficient and economical operation.

For new plants the services of specialists in our Consulting Division include: analysis of water conditioning requirements... design of treatment system... preparation of specifications... procurement and evaluation of bids... supervision of erection... acceptance test runs... operating instructions for plant personnel... and continuous supervision.

We suggest you write us for further information.

LABORATORIES AND ENGINEERS LOCATED THROUGHOUT U. S. A. AND CANADA

W. H. & L. D. BETZ

FRANKFORD • PHILADELPHIA 24 • PENNA.

Control within negligible limits of variation

Valves built to meet exacting requirements in the control of steam, liquids and air. Types, sizes and construction for specific requirements and conditions in wide field of application.

ACCURATE, DEPENDABLE PRESSURE REGULATION

(At right) Stickle Standard Regulating Valve. Double seated, semi-balanced. All working parts renewable. Seven sizes—½" to 6".

(At left) Stickle Single Seated, Balanced Valve. Internal parts interchangeable. May be repaired at point of service. Eight sizes—¾" to 4".

(At left—below) Stickle Spring Balanced Valve. Diaphragm case detachable. Renewable valve and seat. ½", ¾" and 1" sizes for individual installations on small equipment.

(At left) Stickle Standard Back Pressure Release Valve—double seated, unbalanced type. Designed to meet various operating pressures. Ten sizes—3" to 16".

LONG LIFE

STICKLE VALVES

REDUCING . . . REGULATING

● Stickle Series 400 Valves—single seated with pilot stem—illustrated and described in Bulletin No. 435, and Stickle Series 200 Double Seated Valves, illustrated and described in Bulletin No. 235 are available in three constructions: Lever Operated; Lever and Weight Loaded, Diaphragm Operated; and Spring Loaded Diaphragm Operated. Self-contained and Pilot Operated. Proved by long use in fields where dependability and accuracy are required. Ask for Bulletins.

STICKLE STEAM SPECIALTIES CO., 2265 Valley Ave., Indianapolis, Ind.

perature within the cylinder and thus indicate that something is wrong with valves or piston rings. This requires a thermometer-well in the pipe near the compressor cylinder. The thermometer may be either an indicating one, which must be read at intervals, or a recording one, which provides a permanent temperature record throughout the operating period. Fig. 2. Thermometers are not so necessary on low-pressure compressors, but are valuable when machines operate at high pressures.

Multi-stage temperature protection. On multi-stage compressors of 2, 3, 4, 5 or 6 stages for high pressures, a thermometer on each cylinder discharge is the best means of determining whether the compressor is functioning normally and safely. Recording the operating temperatures and pressures of each stage on an engine-room log chart at definite intervals serves the same purpose as taking the temperature and pulse of the human body. Indicating thermometers are good, but recording ones give a definite and permanent record.

Recording discharge gage. A record of the pressure variation in the discharge line throughout the day is often desirable. A recording pressure gage provides this.

Used Equipment

(*Continued from page* 111)

a 125-v dc generator. The latter and its coupling were removed from a steam turbine. A stock motor-generator set, consisting of a 750-kva 13,000-v ac motor and 550-v dc generator, furnished the motor. Its 13,000-v winding was reconnected to operate on 4150 volts, and the customer had the set he needed.

This was the way a paper company's problem was solved: Because a nearby river overflowed periodically into the plant, engineers decided to place additional motor drive overhead. Large and heavy motor pulleys required a third bearing to support the heavy belt pull. Placing the motors overhead would put the V-belt at such an angle that it would encircle a section of the bedplate. The rebuilding shop furnished the motors on a fabricated bedplate with a removable insert to permit putting on the belts. After the belts are mounted, the insert is bolted tightly and securely in place.

Air compressors coming into rebuilding shops receive a water test on cylinder jackets to expose cracked walls and heads. After the unit is dismantled, dirt

then I said to myself-

This "BIG STICK Policy" ups production 140%

Teddy Roosevelt had a good idea in 1901 when he advised, "carry a big stick, and you'll go far."

Yes, by today's arc welding standards that "Big Stick Policy" is still good.

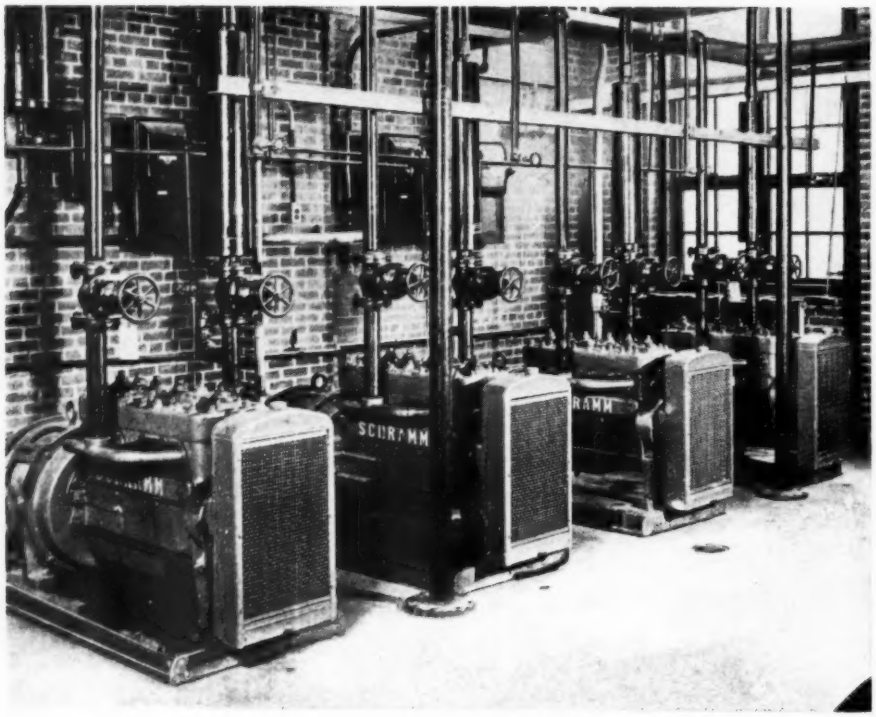
Right! USE THE BIGGEST POSSIBLE STICK OF ELECTRODE, AND YOU'LL GO FAR.

Look what they're doing in this shop. By boosting electrode size, output of tank track sections was increased like this:

Size "Fleetweld" Electrode	Parts Welded Per Hr.
1/8"	10
5/32"	17
3/16"	24

Swell! 3/16" electrode may not be a giant but it got "big stick" results here . . . an output increase of 140%. Some shops are boosting electrode size up to 3/8". It all depends on the nature of your work. You can get "big stick" advice from Lincoln.

THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio



Lots of Power...

BUT EASY TO HANDLE!

Here's four of a battery of #210 cu. ft. actual air Schramm Compressors, operating as a unit system for a large industrial plant. They're taking care of the variable maximum and minimum load, automatically, 24 hours a day—*with minimum attention!*

Schramm was specified because it provides heavy-duty, continuous operation with least attention, upkeep and operating costs.

Schramm Air Compressors are available with various types belt drives, as well as built-in motor drive and direct connected diesel or gasoline engines. Each unit is lightweight, compact, with capacities up to 600 cu. ft. displacement.

Long-life features of Schramm include: mechanical intake valve ... vertical piston travel and horizontal valve action ... sturdy support for cylinder head ... and forced feed lubrication.

Other Schramm features are likewise outstanding. Write today for complete details in Catalog 42-S.

SCHRAMM INC

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

and grease are removed by cooking the parts in a cleaning solution. Each piece is put in good condition before reassembly. Badly worn valves are replaced. Out-of-round cylinders get rebored and fitted with new pistons and rings. Rebabbitting takes care of worn bearings.

When demand was heaviest for horizontal air compressors, which WPB now considers critical, stocks of used-equipment dealers helped to avert a serious shortage. A large part of their present work is refitting oil-lubricated compressors with aluminum pistons and carbon rings for war industries that need oil-free air.

Readers' Problems

(*Continued from page* 120)

eral hours before pounding leads me to believe that the liner is contracted and gradually expands enough to allow the very hot water to blow past the packing. This is only my opinion but I am sure that if AGF lowers his feedwater temperature the trouble will be eliminated.

Baltimore, Md. C W PARKS

Air Chamber Too Small

AN OBSTRUCTION in the suction line, such as a piece of broken baffle from the feedwater heater, a gate valve out of order, or one not completely open, may cause AGF's trouble. The pump would start pounding with an increase in speed, because sufficient water would not be available for pump suction.

Again the trouble may be on the discharge side of the pump from lack of cushioning. An installation of this kind requires an auxiliary air chamber on the discharge line to boiler, because the pump is a simplex unit and boiler pressure is high. If this air chamber is not large enough or not installed in the proper way then pounding will occur with an increase in speed of the pump.

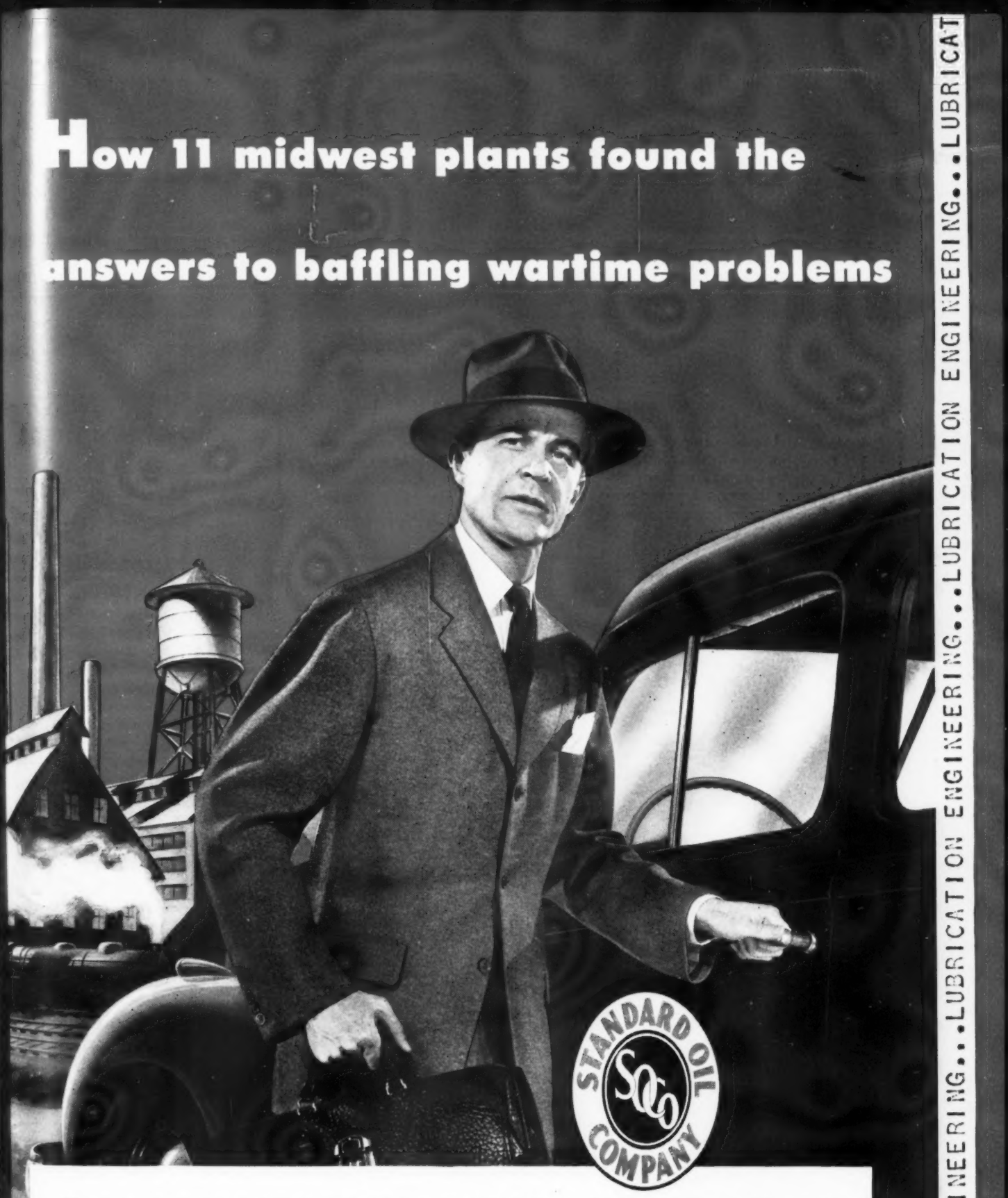
I believe that AGF's liner scoring is caused by dirty feedwater or by using the wrong kind of packing.

New York, N. Y. JAMES DALY

Check Water- and Steam-Cylinder Alignment

AGF SHOULD CHECK the cylinder liner for tightness, and the alignment of the water cylinder with the steam cylinder. A simplex pump operates at a higher speed than is common with a duplex

How 11 midwest plants found the answers to baffling wartime problems



YOUR MAIN CONCERN, these days, is to get on with the war... and so is ours. To that end, we suggest you read, on the following pages, typical examples of Lubrication Engineering at work. See the great step-up in man and machine production that many plants have secured.

This is a service of specialists... lubrication and cutting oil specialists. Their "know-how" comes from the great fund of practical information which is the background of this company, and from rubbing shoulders with plant men in solving many a problem. The experiences of all these specialists is pooled, so that the experience of one is the experience of all. And when more help is needed, they have at their disposal all the resources of our Technical and Research Departments.

It's a set-up for solving problems. Better turn it loose on some of yours.

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICAT

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION EN

Lubrication *News* letter

Practical suggestions from the field on how Lubrication Engineering and lubricants are being used by midwest operators to lick tough wartime jobs.

SEPTEMBER, 1943

Quieter valves . . . no scoring . . . with 40% less cylinder oil. Rough running valves and scoring of the low pressure cylinder in a cross compound Corliss engine became a serious problem when it interrupted power production for war work in a central states plant. Even large quantities of an expensive cylinder oil fed into the high pressure steam line failed to give adequate lubrication.

Then a Standard Lubrication Engineer's suggestion was tried. A small lead was installed from the high pressure steam line to a Superla Atomizer in which steam condensate and oil were mixed and then fed to the low pressure cylinder. Separate oils were used for the high and low pressure cylinder lubrication. This, plus the more complete atomization of the oil, ended the trouble. After six months' operation all parts show excellent lubrication. Consumption has dropped 40%.

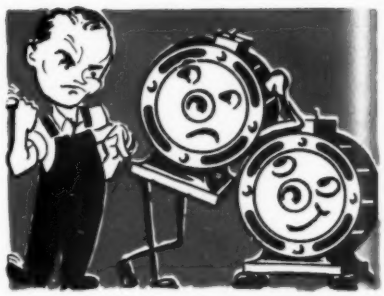
You don't need weather reports with Stanoil. Quick changes in temperature are no problem when you have Stanoil in motors, speed reducers, and other equipment exposed to the weather. Stanoil's high viscosity index —its ability to resist changes in fluidity over a wide range of temperatures— plus its low pour test, assure a free flowing oil at low temperatures and adequate lubrication at normal operating temperatures.

A Wyoming operator reports that speed reducer operation in severe cold weather had always been troublesome until Stanoil was used last winter. Result, no starting trouble, plus a substantial power saving.

What are your problems in maintenance and lubrication?

The few examples cited here are typical of the jobs Standard Lubrication Engineers are doing daily for operators who have asked for help. Take the time to explain your problems to one of these Engineers. He may have a number of suggestions that will help you save much needed manpower, materials, and scarce equipment. Call any local Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 5, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Saves four out of five gallons of oil with Stanodrip diet. In an 8-day test, one gallon of Stanodrip was needed in place of five gallons of regular oils formerly used to lubricate a wire-bending machine in an Illinois plant. Add to that the time this saved in lubricating the machine and in cleaning excess oil from the machine and floor, and it is easy to see why this manufacturer started looking for more spots where Stanodrip could be used. Why not put some of the oil-hungry bearings in your plant on a diet of Stanodrip?



Better lubrication puts idle stand-by motor to work. Bearings on the motor driving a ventilating fan in a Michigan mine failed often enough to require keeping a stand-by motor on hand to take over this important job. But when spare motors became scarce, and the extra bearing maintenance and replacement a problem, special effort was made to eliminate the trouble. That's when a Standard Lubrication Engineer was asked for his opinion. His analysis led him to recommend Superla Grease No. 2X. That was two years ago. No bearings have failed on this motor since then. The "stand-by" now fills an important job elsewhere.

6 months in hydraulic system is "only the beginning" for Stanoil. Here's a practical demonstration of oil stability you hear so much about. Three bomb spinners in a Wisconsin plant had operated eighteen hours a day for six months. Long enough, ordinarily, to require changing oil in the hydraulic system. But when the oil was examined there was no sign of discoloration or deposits. The oil was like new and it was left in the units. It was Stanoil. A Standard Lubrication Engineer had "sold" the idea of using this high stability oil to eliminate deposits and replacements. It is doing all he promised and more.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

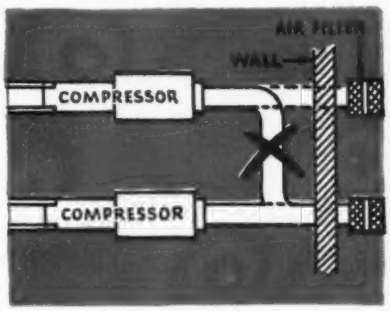
Grease-well solves girth gear lubrication. Here's how the problem of lubricating open gears on kilns and tube mills was solved in an Iowa cement mill. When a new kiln was installed the operator and a Standard Oil Engineer went into a huddle—a fool-proof method of protecting the large girth gear and pinion was the object. This is the method they devised:

Part of the gear shield on the new kiln was blocked off to form a well from which the gear teeth pick up a small amount of lubricant as they revolve. Scrapers were attached to the shield to remove excess grease and return it to the well. A large drain plug was provided to permit changing the grease as it became contaminated with abrasive.

With Calumet Viscous Lubricant and this method of application, both the gear and pinion show a high polish after one year's operation with no sign of wear. Where possible, other gears were similarly equipped—with the same highly satisfactory results.

Stoker maker ends hunt for bearing seal. Leakage around the shaft bearings on the gear case of his stoker drive bothered the manufacturer. The grease used to lubricate these ball bearings also had to seal the oil into the gear case. He'd tried many greases without complete success until a Standard Oil Engineer gave him a sample of Stanobar Grease—a new, smooth type, pressure gun grease recently developed by Standard Oil. With the first test of Stanobar, his search was ended. The grease stayed in the bearings—the oil stayed in the case.

Saves worm gear life . . . turns to E. P. (extreme pressure) lubricant. The worm gear drive on a chain-grate stoker needed replacing after only two years' operation in an Illinois mill. The second set of gears installed showed signs of wear after just thirty days. Operating conditions were not unusual. Both worm and ring gears were steel. The ring gear dipped into a bath of lubricant carrying it to the worm above. A heavy bodied, worm gear oil was used. But a Standard Lubrication Engineer saw what was wrong. An E. P. lubricant was needed. Stanogear Leaded Lubricant was his recommendation. With it this drive has operated eighteen months—there is no sign of wear to date.



"Give 'em air" is Engineer's solution to compressor problem. When reconditioning the rings and valves of two compressors failed to improve their output of air, a Minnesota operator was stumped. Then he called a Standard Oil Engineer—he thought it might be a lubrication problem. It wasn't, but that didn't stop the Engineer. He noticed that the intake lines from the compressors were connected together. He suggested that larger suction lines be installed—one for each compressor. With no other change, both compressors deliver their rated capacity—run smoother, too. Engineering service like that is part of a Standard Lubrication Engineer's job.

How does your experience in ice machine lubrication stack up with these records? Speaking from ten years' experience operating York ice machines, a Minnesota operator says, "Since we have been using Stanolind Ice Machine Oil, our maintenance has been very low—we have had absolutely no bearing trouble, no trouble with oil congealing in the system, and rings have been replaced only once."

A creamery company, operating two 5-ton York machines, reports, "We have used Stanolind Ice Machine Oil for the past ten years without any trouble from ring and cylinder wear. The oil does not get into the cooling units, and we get better refrigeration in our storage rooms and pasteurizer."

See if a Standard Lubrication Engineer can't help you get results like these on your refrigeration equipment.

Leakage . . . high consumption . . . and high costs . . . all three cut with Stanodrip. With a regular engine oil for general bearing lubrication on line shafting and mill equipment, consumption was high and leakage a problem at a Missouri milling company. A switch to a high-priced dripless oil eliminated leakage, but skyrocketed lubricant costs. One more shift—to Stanodrip—solved all three problems. Consumption was reduced from ten barrels to five barrels yearly; leakage was practically eliminated; and costs dropped materially, both because of the saving in lubricant and the saving in time formerly required to pour oil through the bearings.

Where Standard Lubrication Engineering is available. You can secure help on your cutting or lubrication problems in the Midwest and Rocky Mountain states shown above. Phone or write the nearest Standard Oil Company (Indiana) office, or 910 S. Michigan Ave., Chicago 5, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Oil is ammunition . . . Use it wisely

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The rout of the unstable hydrocarbons

(Important to turbine oil users)

It would be a happy day for oil men, if petroleum's hydrogen and carbon atoms, once having united, would remain inactive. But some of these hydrocarbons are unstable -- they're on the hunt for oxygen. When they get it, they're bad actors. In turbine oil, they cause deposits, sludge, acidity, poor demulsibility, etc. Some of them tend to form asphaltenes, others to form acids. Refining can remove all the asphaltene-forming type, but at the cost of also removing valuable anti-oxidants. Therefore, some of these trouble makers are left in conventional turbine oils. The asphaltene-formers are all removed from Nonpareil, but the anti-oxidants are restored by adding a patented inhibitor. The acid-forming hydrocarbons can't all be removed by the refining process, but the addition of this inhibitor renders them harmless. As a result, we are able to guarantee that Nonpareil's acidity (as expressed by neutralization number) will never exceed 0.15. In service, the number is more likely to be about 0.05, without batch treatment, resting, or replacement, as has been proved in hundreds of turbines. Thus, by beating the two basic types of oxidation troubles, Nonpareil Turbine Oil is able to and does stay clean -- retains its "new-oil" condition -- permanently.

Use it, and you'll never again need to clean your turbines. A Standard Lubrication Engineer will gladly furnish details, service records, and further proof. Phone, or write your nearest Standard Oil Company (Indiana) office, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, address Standard Oil Company of Nebraska at Omaha.

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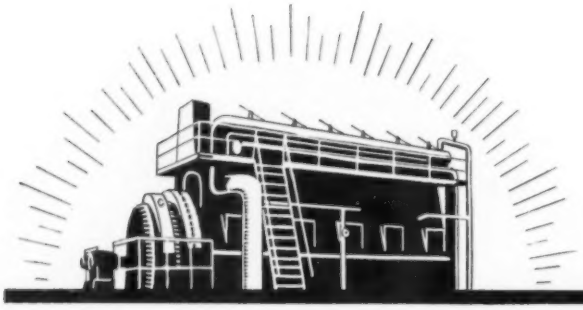

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Accurate measurement of the flow of lubricating oil is one of the many small but highly important jobs that are necessary to keep Diesel engines perking along at peak performance.

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have proved to be ideal for measuring the flow of those lubricating oils. They accurately register the rate of flow from zero to 100%. The graduations on the dial are uniformly spaced from one end to another and read direct—without constants. A long useful life, even under today's twenty-four hour schedules, is assured by the all-around rugged construction of every Henszey Flow Indicator. There are only three moving parts—so breakdowns due to complicated mechanisms are eliminated. It can be installed right in the pipe line.

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and the piston reversal causes a thrust against the liner, causing it to wear rapidly where the reversal takes place. He should also check the water source to make sure that no abrasive solids are present.

Pitting of the bronze valves gives evidence that electrolytic action is taking place because of the high temperature and the dissimilar metals or because the water is acid. The fact that the pump pounds after several hours of quiet operation indicates loss of air from the air chamber, assuming that there is an air chamber on the discharge line. Where a pump works at a discharge pressure greater than 150 psi, an air chamber is not of much service because the air might be forced out at the joints or be absorbed by the water. Another drawback of using an air chamber where the discharge pressure is 175 psi is the added cost of supplying compressed air at this pressure.

To eliminate the above defects a device called an alleviator is used. It consists of a plunger working through a water-packed stuffing box. When the discharge pressure exceeds working pressure the alleviator plunger is forced out through the stuffing box, and a cushioning effect takes place that relieves the pump and piping from the shock that would otherwise occur. The alleviator is attached to the pump discharge at a point where the pipeline makes a right-angle turn.

New York, N. Y. PAT DONOHUE

Bronze Composition May Be Faulty

IN ABSENCE of any chemical attack, AGF's troubles must be caused by a conglomerate sponge structure of the castings used for the valves and liner. The structure was hidden under an apparently sound exterior surface and came to evidence after the pump was in operation for some time.

The well-balanced bronze compositions used before the war for pump liners and valves were produced with regularity as sound castings. They had a low coefficient of friction combined with a high resistance to wear, pounding and corrosion. Critical shortage of certain components of these compositions made it necessary to use substitutes with less comparative performances. These substitute bronze compositions are probably the cause for AGF's troubles with valve pitting and liner scoring, because they are more difficult to produce as sound castings

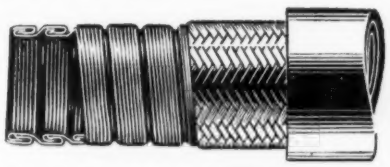
What sharp eyes they have

EVEN on moonless nights and in pea-soup weather our pilots can "see" their way to the enemy target, and back home again—thanks to the precision instruments with which their planes are equipped. Little wonder then that protecting the low-tension wires, the optic nerves upon which those all-weather eyes depend, is such an important task—and one that is often entrusted to American Flexible Metal Shielded Conduit.

And because of its unfailing protection, flyers hear their radio signals and instructions clearly, undistortedly . . . static interference can't gum up their teamwork as a combat group.

Protecting low-tension wires on delicate aircraft instruments is only one of the important jobs assigned to products of American Metal Hose. In industry, various types of American Flexible Metal Hose and Tubing convey water, gas, steam and oil; it's also used in vacuum service for removing filings and dust; as misalignment connectors or for absorbing vibration in pipe lines—to name but a few applications where these products serve with distinction.

When you have an application requiring metal hose or tubing, regardless of its nature, we invite you to "go American." For in the American line there's one that can probably help you do the job just a little bit better. 43202



American Flexible Metal Shielded Conduit for the protection of low tension wires on aircraft instruments. Available either with fittings attached or in coils with fittings loose.

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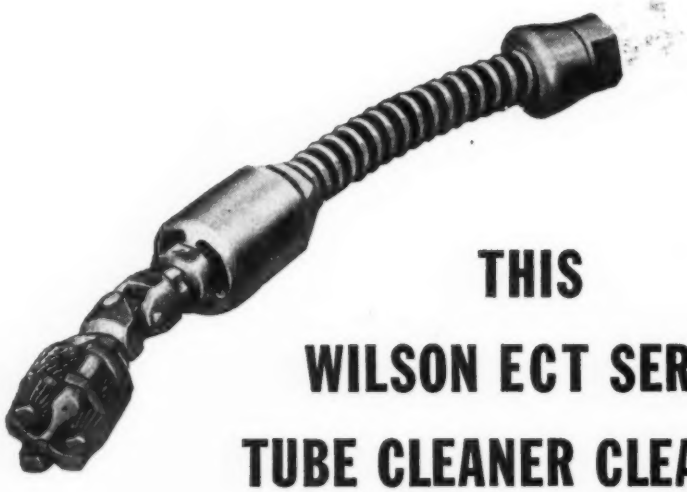

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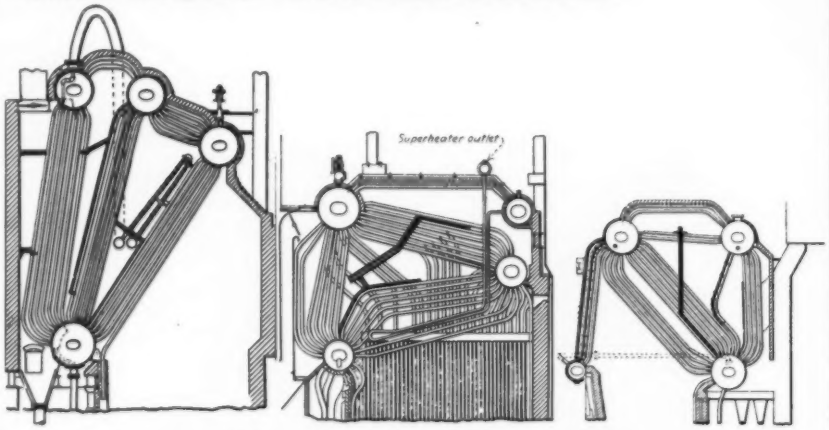

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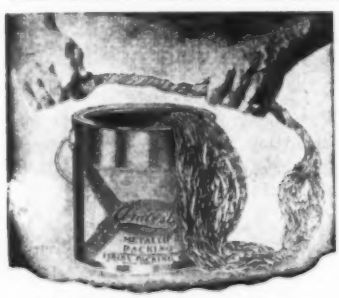

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"EUREKA"

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

with a uniform surface free of blow holes, cracks and sponge material.

Pounding of AGF's pump, after hours of quiet operation, is a result of the hot water flashing into steam under the momentarily reduced pressure at the point of piston reversal in addition to the heat accumulation, as explained in the following.

Sliding friction between packing and liner, and liquid friction of the continuously slipping liquid, both aggravated by the scored liner, and the lowered heat transfer of the pump body to the surrounding air after hours of continuous operation—which is common for equipment in confined places—cause an accumulation of heat. With feedwater of 205 F entering the pump, this additional heat causes the small temperature change necessary to cause flashing in combination with the momentarily reduced pressure at the point of piston reversal. The remedy lies in reducing slightly the temperature of the feedwater. Or as I saw done with success during the dark hours of a night shift—have someone turn the cold-water hose on the pump casing to cool it down so that the pump runs quietly.

Philadelphia, Pa. EMIL WITTMAN

Packing Must Be Soaked Before Inserting

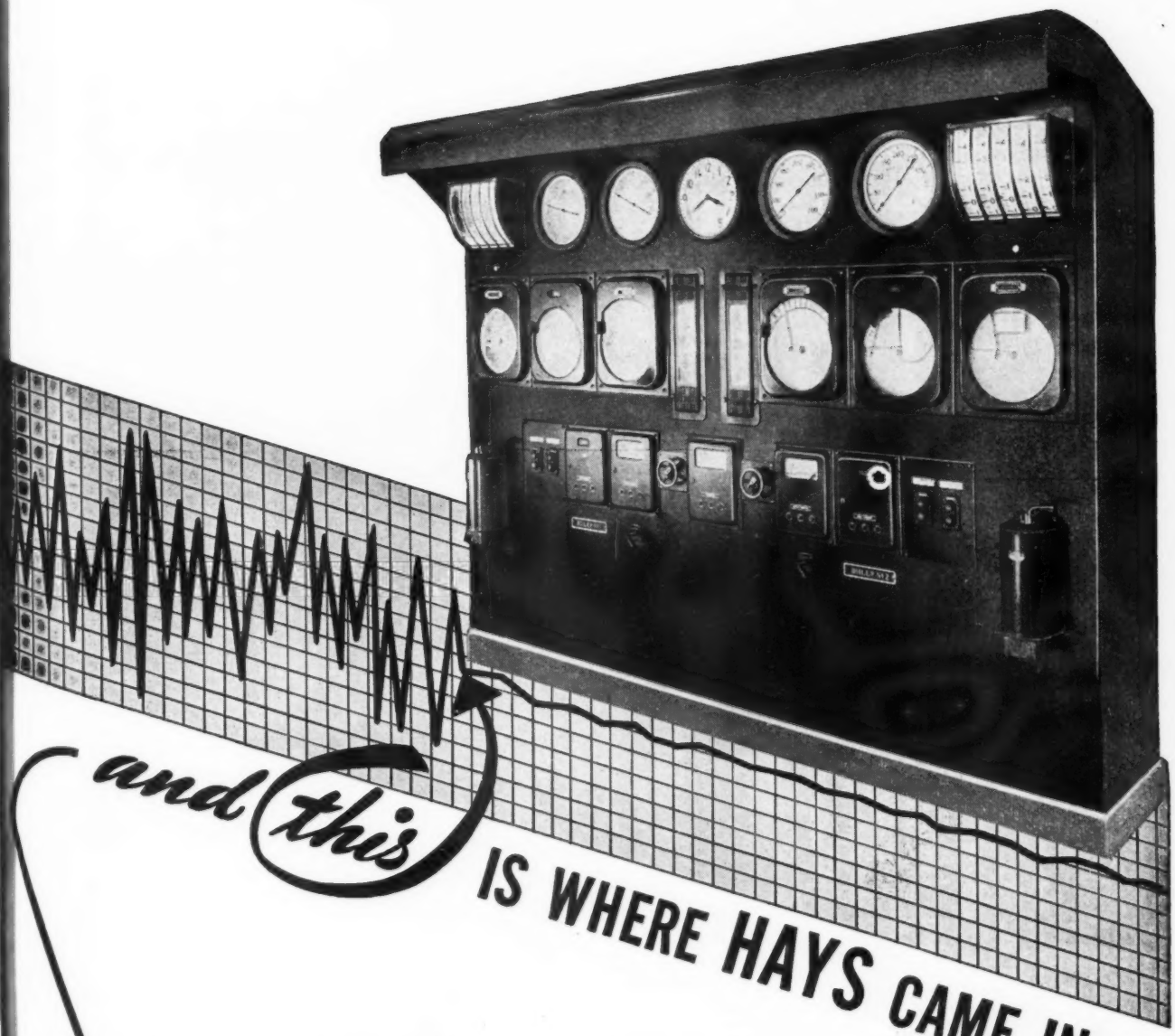
FIBROUS PACKING should be soaked in boiling water three to six hours before inserting it in a pump. While wet and hot, fit it to cylinder lining (not to pump piston). The fit should be made with a gap of not more than $\frac{1}{32}$ in. When fitting is complete, place packing back in boiling water.

Then place rings on the piston, pushing them tightly against the piston follower when tightening up.

Successful packing of the pump piston requires that the packing be tight against the piston shoulder and follower plate, but not so tight that the pump pressure cannot get under the packing to keep it against cylinder walls. Too much expansion of packing causes breaking of follower bolts, and distorting or breaking follower. He might try hard rubber, Bakelite or copper valves.

Fitting any type rings loose or free permits them to *roll* on each reversal of stroke. In the case of a metal ring it will become rounded on the outer wearing surface. It has been found that soft packing will break up at the corners and tear.

Experience has taught me that analyzing feedwater to determine its action on metals while a pump is oper-



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Maintaining constant steam pressure, developing low cost steam, saving fuel, reducing man-hours are a few of the common sense results being achieved daily in industrial steam power plants by Hays Control.

These results are particularly desirable in an all-out drive for greater production of war material. And greater production starts at the source of power—power to drive the machines that turn out the tanks and planes and battle ships.

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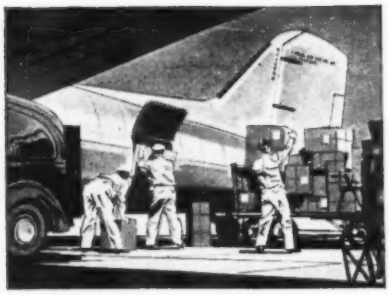

Effective July 15th, Air Express rates within the United States were substantially reduced — many reductions ranging as high as 12½%, depending on the weight of the shipment and the distance it moves. As a result, the average saving to shippers amounts to 10½%.

Increased volume of Air Express traffic stimulated by wartime demands on this fastest form of shipping service—accompanied by peak efficiency in handling—has made it possible to pass these savings along to shippers of air cargo.

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NOTE TO SHIPPERS: To keep costs down—*pack compactly*, obtaining best ratio of size to weight. To insure fastest delivery—*ship when ready*—as early in the day as possible. **ASK** for our new 1943-44 CALENDAR-BLOTTER. Write Department PR-10, Railway Express Agency, 230 Park Avenue, New York 17, New York.

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Gets there FIRST

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Representing the AIRLINES of the United States

ating is like examining an electric generator. While the machine is idle one condition exists; start the generator and you have electric current. Put water into motion and the reaction to metal changes.

When the pump is started, the air chamber may have sufficient air for cushioning. After operating a few hours, the air may be absorbed by the water, removing the cushion. This condition can be overcome by charging the chamber with air.

The suction head is ample for the average temperature, but should water become hotter, it will flash to steam on entering the pump.

A cold-water line, connected near pump suction, could be installed and cold water added to lower the temperature.

Should condensate returns become greater after a few hours' operation, and build up a greater static suction-head pressure, the suction valves may not close properly until the pump reverses and then they will come down with a slam. Heavier springs would cure this.

Hempstead, N. Y. H A SCHREIBER

Packing Not Suitable For Installation

AGF SHOULD CHECK the pump cylinder barrel to see if it is smooth over its entire inner surface. He should then check the packing being used. To be positively correct, consult a concern making all types of packing; they will be glad to help.

The temperature of 205 F is high even with the 15 ft static head, so if the pump runs faster at times than the suction can supply water this will cause steam binding and pounding. If the pump does not have one, and the discharge to the boiler is a long line, an air chamber would help.

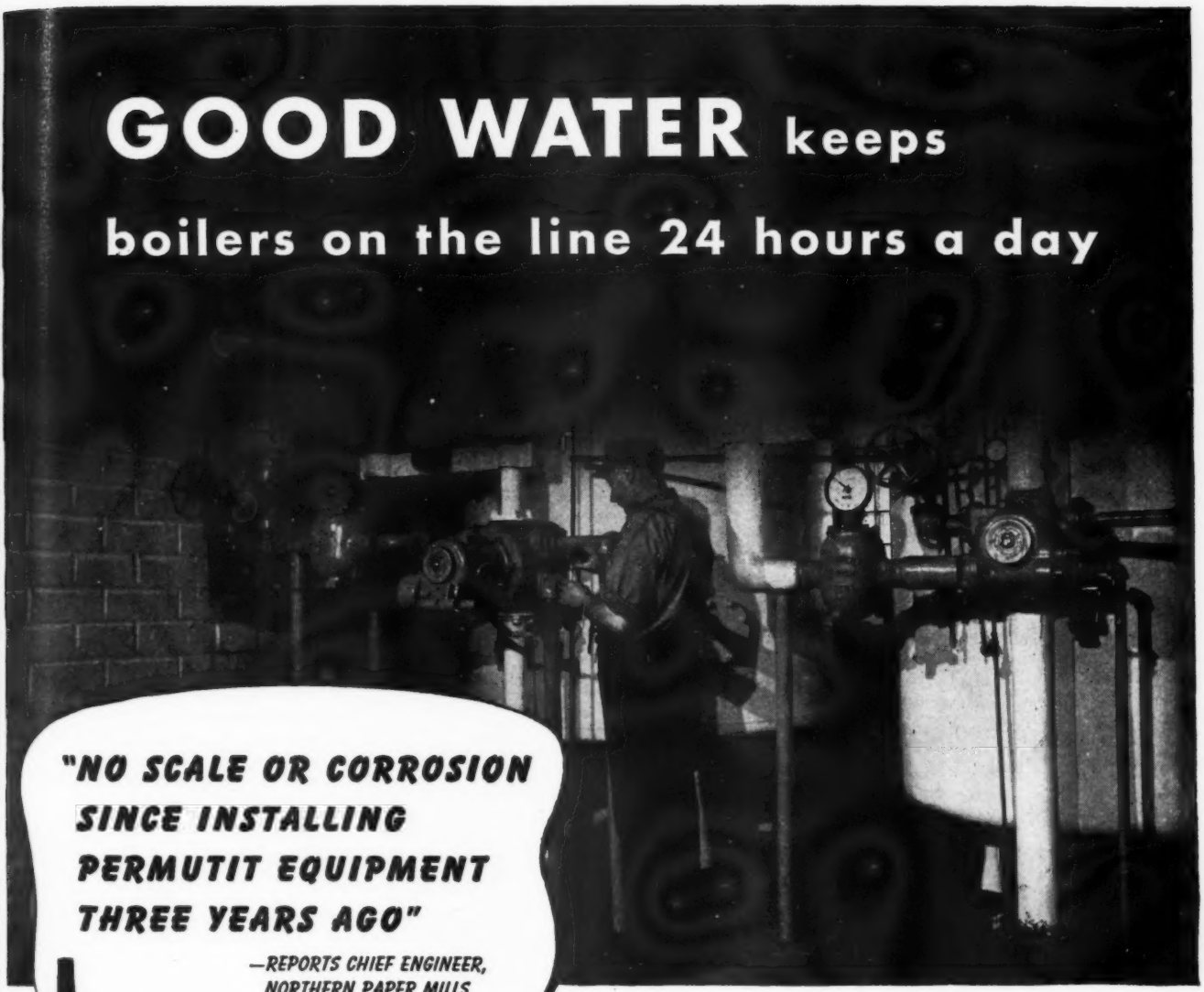
I have packed our feedwater pumps many times and have never soaked the packing. I find that if packing is bought in the proper size rings and installed correctly it will not be torn; a torn ring is a sign of inferior packing, wrong kind of packing or poor installation. Manufactured packing rings are always more reliable than rings cut by hand and fitted.

After thoroughly inspecting the pump AGF should inspect all the valves, especially the check valve in the discharge feedwater line.

Philadelphia, Pa.

T F CUNNINGHAM

GOOD WATER keeps boilers on the line 24 hours a day



"NO SCALE OR CORROSION SINCE INSTALLING PERMUTIT EQUIPMENT THREE YEARS AGO"

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The new plant has a high pressure boiler operating at 650 pounds gauge and 700 degrees total temperature. Raw water, from a deep well, shows hardness of 240 ppm. Makeup is about 50 percent.

The exacting demands of the new boiler and the hardness of the water made modern water conditioning essential. So Permutit Zeo-Karb* H and Na Softeners (shown above) were installed, with a Permutit Deaerating Heater and a Permutit Condensate Filter.

Mr. H. W. Gochnauer, Chief Engineer, reports that the boilers, inspected every six months, show *no scale or corrosion.* Tests show continuous zero oxygen. Mr. Gochnauer expressed complete satisfaction with the equipment.

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Power Clinic

(*Continued from page* 91)

still be distributed equally in all field poles.

The stator winding of the motor was connected series-star for 2200 v, as in Fig. 4. We reconnected this winding for 440-v operation, 4-parallel star,

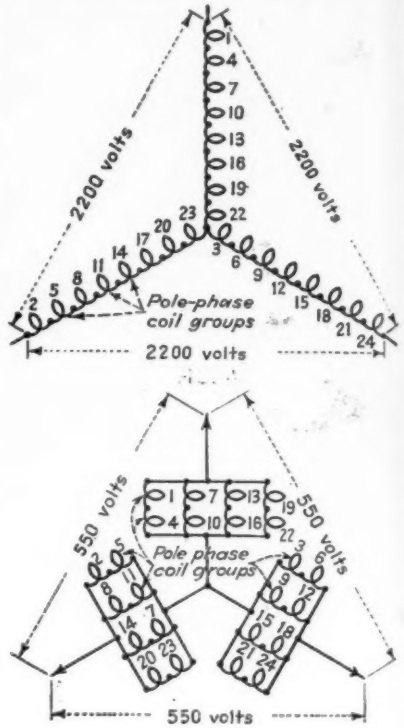


FIG. 5

Fig. 4—Original series-star-connected stator for 2200-v. Fig. 5—Reconnection of stator coils for 4-parallel star reduced normal voltage to 550, further reduced to 440 v by a rheostat

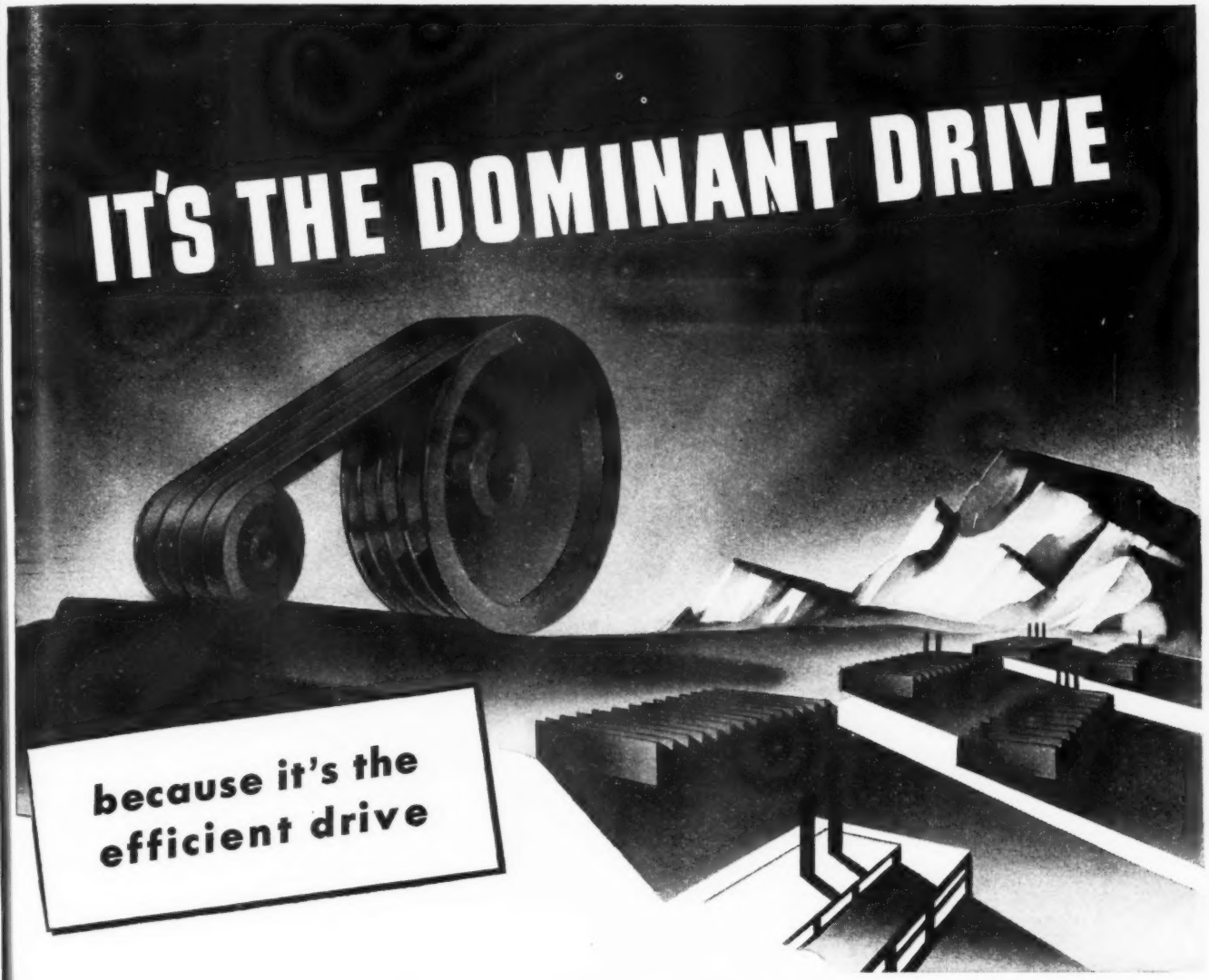
Fig. 5. This connection was good for about 550 v with normal excitation in the field coils. We reduced the voltage to 440 by the field rheostat. This was equivalent to reducing the machine's capacity about 20%, but since the motor had more capacity than needed for the generator load, the reconnected stator worked satisfactorily.

To drive the generator, we connected it by a multiple V-belt to the flat rim of an engine flywheel. Because of the large ratio (about 8:1) of the flywheel to the V-sheave, we installed a flat idler pulley on the top side of the belt.

This change gave us a badly needed generator and saved critical material necessary to build a new machine. The old dc generator was scrapped and the amount received from the sale of the copper and iron salvaged more than paid for the multiple V-belt sheaves for the generator and exciter.

Sayre, Okla. G M HARDY

IT'S THE DOMINANT DRIVE



because it's the efficient drive

If, just two decades ago, the prediction had been made that in a few, short years, one industry after another would change over to a new, and as yet unheard of type of power transmission, that prediction undoubtedly would have been met with profound skepticism.

Yet that is precisely what has happened. And, it has happened because the group of engineers who developed that Multiple V-Belt Drive never faltered – never quit until they had proved its high efficiency by hard, cold, indisputable facts obtained from the laboratory and the field.

These facts will be presented to mechanically minded America in a series of advertisements by the members of the Multiple V-Belt Drive Association – whose unceasing engineering efforts and co-operative interchange of experimental and field findings were responsible for the widespread acceptance of the Dominant Drive of Industry.

The use of this emblem by an association member in connection with Multiple V-Belt Drives is assurance of mechanical excellence...the result of co-operative engineering, research and experience.

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Santosite, an anhydrous crystalline product is easy to handle, store and apply.

Complete details on the application of Santosite to your boiler feed water will be sent promptly upon request to: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.

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MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

Questions, Answers

(*Continued from page* 124)

ceding answer and evaluating to nearest 100 lb: (1) $P \times t \times T_s = 4 \times 0.375 \times 55{,}000 = 82{,}500$ lb; (2) $(P - d) \times t \times T_s = (4 - 1) \times 0.375 \times 55{,}000 = 61{,}900$ lb; (3) $2 \times s \times a = 2 \times 44{,}000 \times 0.785 = 69{,}100$ lb; (4) $2 \times d \times t \times c = 2 \times 1 \times 0.375 \times 95{,}000 = 71{,}300$ lb. As (2) (strength of plate between rivet holes) is lowest, efficiency of joint $= \frac{61{,}900}{82{,}500} = .75$ *or* 75% *Answer.*

Q 16—How do you find efficiency of a triple-riveted butt joint with two unequal straps and alternate rivets omitted in outer rows?

A—Here (Fig. 9) are the equivalent of five rivets in one pitch: four being in double shear and one in single shear. As there are a greater number of rows of rivets than in the previous riveted-joint examples, some extra calculations have to be made, as follows: (1) strength of solid plate $= P \times t \times T_s$; (2) strength of plate between rivet holes in outer row $= (P - d) \times t \times T_s$; (3) shearing strength of *four* rivets in *double shear* and *one* rivet in *single* shear $= 4 \times S \times a + s \times a$; (4) strength of plate between rivet holes in second row, plus shearing strength of one rivet in single shear in outer row $= (P - 2d) \times t \times T_s + s \times a$; (5) strength of plate between rivet holes in second row, plus crushing strength of butt strap in front of one rivet in outer row $= (P - 2d) \times t \times T_s + d \times b \times c$; (6) crushing strength of plate in front of four rivets, plus crushing strength of butt strap in front of one rivet $= 4 \times d \times t \times c + d \times b = c$; (7) crushing strength of plate in front of four rivets, plus shearing strength of one rivet in single shear $= 4 \times d \times t \times c + s \times a$.

Q 17—What is efficiency of a triple-riveted butt joint with unequal straps and alternate rivets omitted in outer rows, if outer pitch is 7 in., rivet diameter 1 in., thickness of plates $\frac{7}{16}$ *in., and thickness of butt strap* $\frac{3}{8}$ *in.?*

A—(1) $P \times t \times T_s = 7 \times 0.4375 \times 55.000 = 168{,}400$ lb; (2) $(P - d) \times t \times T_s = (7 - 1) \times 0.4375 \times 55.000 = 144{,}400$ lb; (3) $4 \times S \times a + s \times a = 4 \times 88.000 \times 0.785 + 44{,}000 \times 0.785 = 311{,}000$ lb; (4) $(P - 2d) \times t \times T_s + s \times a = (7 - 2) \times 0.4375 \times 55{,}000 + 1 \times 44{,}000 \times 0.785 = 154{,}900$ lb; (5) $(P - 2d) \times t \times T_s + d \times b \times c =$

CONTINUE TO "GUARD THOSE VALVES"

Since such tremendous tonnage must be carried to forces around the globe, it is easy to understand why Reading-Pratt & Cady for so long have advised you to "guard those valves." Ships are a maze of valves. ★ Strides toward victory should not encourage the thought that the transport of matériel for fighting Americans be put in jeopardy—so that we at home might have more. Now is the time to put into war every ounce of drive we can muster. Continue to guard your valves.

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D'ESTE VALVE AND ENGINEERING SPECIALTIES

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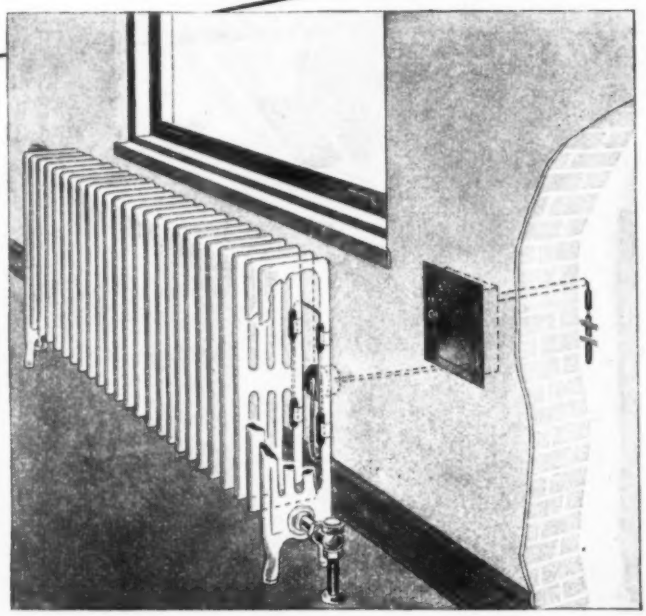
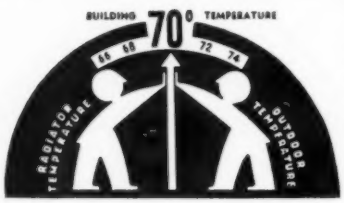
A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT**

JOHNSON
DUO-STATS

For Greater Fuel Economy in Steam and Hot Water Heating Systems



★ WARTIME NOTE— DON'T WASTE FUEL



Johnson DUO-STATS automatically "change the size" of the heating system as outdoor temperatures vary

● A heating plant must be large enough to produce an indoor temperature of 70 degrees, or more, on the coldest days. Only a fraction of that heating effect is needed, however, during the many days of moderate weather. The Johnson Duo-Stat, by means of an outdoor element and averaging bulbs actually attached to the heating system, measures temperature changes instantly. The flow of steam or hot water is automatically adjusted to maintain proper balance between outdoor and indoor temperatures. The Johnson Duo-Stat is the *only* heat regulator that operates in this entirely logical manner. For greatest possible fuel economy, ask a Johnson engineer to submit recommendations and an estimate.

JOHNSON
Automatic TEMPERATURE AND AIR CONDITIONING *Control*
JOHNSON SERVICE COMPANY, MILWAUKEE, WIS. & BRANCHES IN PRINCIPAL CITIES

$(7 - 2) \times 0.4375 \times 55{,}000 + 1 \times 0.375 \times 95{,}000 = 156{,}000$ lb; (6) $4 \times d \times t \times c + d \times b \times c = 4 \times 1 \times 0.4375 \times 95{,}000 + 1 \times 0.375 \times 95{,}000 = 201{,}900$ lb; (7) $4 \times d \times t \times c + s \times a = 4 \times 1 \times 0.4375 \times 95{,}000 + 1 \times 44{,}000 \times 0.785 = 200{,}800$ lb. As calculation (2) gives the lowest result, efficiency of joint $= \frac{144{,}400}{168{,}400} = 0.857$ *or* 85.7% *Answer.*

New Equipment

(*Continued from page* 130)

may be mixed with any paint, varnish, or enamel, eliminating usual odors completely. Does not affect color, drying, or durability of finishes, according to the maker. 1 quart of the solution will effectively neutralize 200 gallons of paint, varnish or enamel. *Holly Chemical Co. 125 East 25th St, New York, N. Y.*

Rotary Pumps

ROTARY PUMPS with anti-friction bearings now available for general industrial use. Capacities range from 10 to 750 gpm, at pressures up to 150 psi. Anti-friction bearing design has the advantage of reducing power requirements and permitting higher operating pressures. As bearings are in contact with the liquid being pumped, new units are recommended only for handling viscous or non-viscous liquids with lubricating properties. Pumps available in all-iron or bronze-fitted constructions, with or without removable liners, also with steam-jacketed heads, and in all standard drives, including gearhead motor. *Blackmer Pump Co, Grand Rapids, 9, Mich.*

Vibration Test Stand

DEVICE FOR TESTING vibration of an electric motor to standards of balance set up by the National Electrical Manufacturers Association announced. Test stand utilizes four rubber columns depending from the triangular cap plates of angle iron corner posts rising from a base plate. Test plate or mounting is attached to other end of rubber columns. Columns are secured to their supports and to plate itself by means of nuts which fit onto threaded inserts bonded into the rubber. Three test sets are provided to accommodate motors ranging from 1 to 200 hp. Mount-

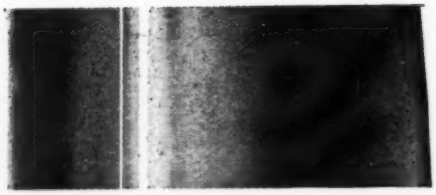
IN 194..? M-H/Brown Electronic Recording and Control Instruments will usher in a new era in peacetime production.

In the manufacture of chemicals, steels, textiles, rubber, ceramics, paper, foods—and other products, M-H/Brown Electronic Instruments will provide a new conception of greater precision in measuring and controlling industrial processes.

We are proud of the M-H/Brown background of over 100 years experience in instrument engineering which *pioneered electronic instrumentation*—that has gone to war—in planes, tanks, ships, etc. When peace comes these instruments will be available to industry. *M-H/Brown Electrons are coming.* THE BROWN INSTRUMENT COMPANY, 4490 Wayne Avenue, Philadelphia, Pennsylvania, a division of MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada — Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by*

MINNEAPOLIS-HONEYWELL



Power and Manpower

ROTO Tube Cleaners Give You Both

Anything that saves manpower today is of prime importance. Every Roto Tube Cleaner equipped with an air valve on the motor releases one helper for other duties. Since the operator himself controls the entire operation of the cleaner, he does not need a helper to turn air off and on every time he removes the cleaner from one tube to another. This not only saves the helper, but also saves time ordinarily lost by signalling between operator and helper.

A Roto Tube Cleaner provides you with a streamlined, concentrated package of power that removes the hardest scale or gummy deposits with a thoroughness and speed that will restore your equipment to top efficiency hours sooner than with old type cleaners. That's the kind of tube cleaner you need today. Write for details.

The **ROTO** Company
145 Sussex Ave., Newark, N. J.

EXTRA STRENGTH...FOR HEAVY DUTY

KEWANEE

FIREBOX BOILERS

4 to 304 hp...100, 125 and 150 lbs. WP...with every characteristic which makes firebox types especially adaptable for Hi Pressure Steam..... *For 6" scale with pipe diameter markings, Write Dept. 96K-IX*

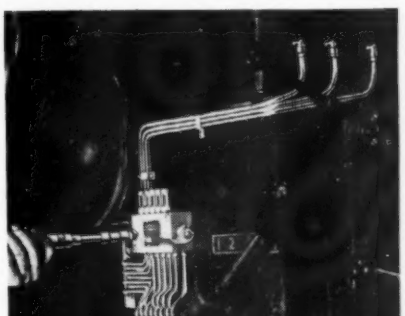
KEWANEE BOILER CORPORATION Kewanee, Illinois

Division of American Radiator and "Standard" Sanitary Corporation

ing plate must be level. With motor running under power on the test plate, as shown in illustration, a pickup or probe is used to take readings from frame, bearings and mount. Dial of the Televiso Vibrometer shown in the picture will indicate amplitudes of vibration of less than .0001 in. *The Reliance Electric & Engineering Co, Cleveland, Ohio.*

Lubricating Equipment

POSITIVE LUBRICATION of all bearings on machines can be had through Multi-val system in which oil or grease under pressure is delivered to the distributing blocks by a manual or power-operated portable gun which serves as a control pump. Complete equipment consists of multiple valve blocks, each serving 2 to 10 bearings, lubricant lines leading to individual points, and suitable fittings to accommodate practically any type of bearing connection. *Farval Corp, Cleveland, Ohio.*



Synchronous Motors

NEW LINE of vertical high-speed, hollow-shaft synchronous motors announced, furnished in ratings from 100 to 1000 hp, and in speeds from 514 to 1800 rpm. Motors have drip-proof enclosure, and are streamlined throughout. Top cover of motor is easily removed to permit adjustment of pump

NICKEL AIDS THE PETROLEUM INDUSTRY

to KEEP 'EM PRODUCING!

Oil is ammunition. On every battle front, oil is war material number one.

Besides power for ships and subs, planes and tanks, trucks and jeeps, it also provides the basic ingredients for synthetic rubber, toluene for TNT, chemicals, and many other essential war materials.

To meet increased wartime demands for oil, field and pipeline equipment carries heavier loads. Refineries make longer runs at high heats and pressures. Engineers add sub-zero cycles and new catalysts. Equipment is taxed up to and sometimes beyond rated capacity . . . precision equipment that cannot be readily replaced.

Despite emergency schedules, however, that equipment rarely fails. For, since the days when shallow wells were drilled with wooden rigs and kerosene was shipped in oak barrels, oil men have relied largely on stressed parts strengthened and toughened by additions of Nickel.

The oil industry knows many uses for Nickel alloyed materials, from crown blocks to drill bits, from sucker rods to pressure stills. Alone, or in combination with other alloying elements, Nickel helps metals resist corrosion, retard wear and absorb shock overloads. Properly used, a little Nickel goes a long way to insure dependable, uninterrupted operation of production and refining units.

For years the technical staff of International Nickel has been privileged to cooperate with petroleum engineers whose pooled information and "know-how" are now so vital to Victory. To men in all industries who desire assistance in the selection, fabrication and heat treatment of ferrous and non-ferrous metals, INCO engineers and metallurgists offer counsel and data.

New Catalog Index

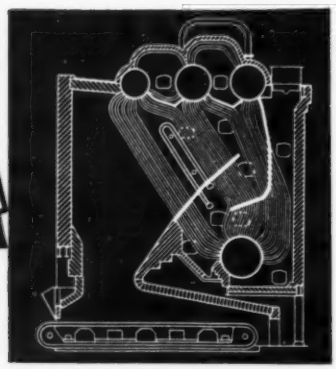
New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

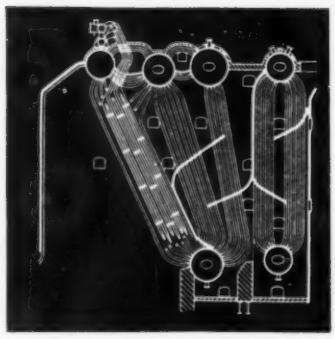
* *Nickel* *

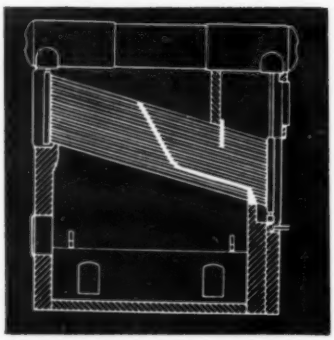
THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

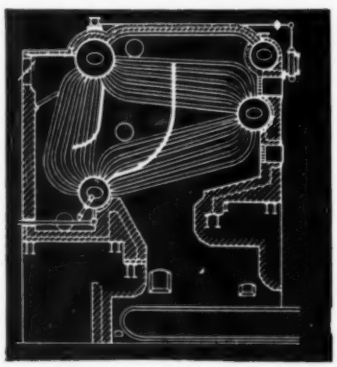
MORE STEAM

Procurable with Improved Baffles









Demands for greater boiler output are often met by installing more efficient baffles.

Overload operation need not be destructive nor cause serious outages due to furnace failures when the heat path through the boiler is well designed.

Enco baffling boosts steam output safely. The cross flow puts every foot of heating surface to work. The streamlining prevents eddy currents and dead gas pockets.

Enco baffles also cut down draft loss by doing away with bottlenecks in the passes. They save steam because soot blowers are used more effectively and less often. They can be applied to any water-tube boiler.

Each application is individually designed by men with 25 years experience in this highly specialized branch of engineering. Installations are made by skilled mechanics.

● ***A bulletin on boiler baffles gives valuable information which every engineer should have. Ask for bulletin BW 40. It's free.***

THE ENGINEER COMPANY

75 WEST STREET • NEW YORK, N. Y.

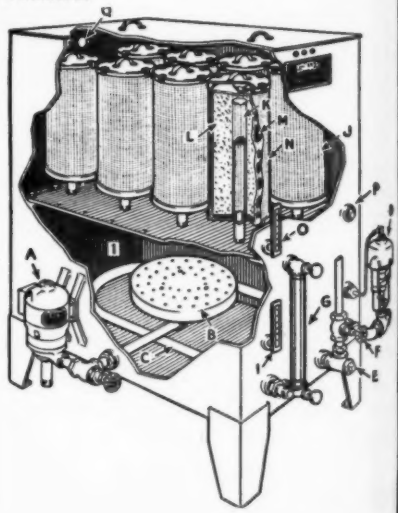
Enco Streamline Baffles

PRODUCED EXCLUSIVELY BY THE ENGINEER COMPANY

shaft. Easy access to brushes and collector rings obtained by unlatching a flush-mounted steel plate. *General Electric Co, Schenectady, N. Y.*

Oil Conditioning Unit

FIG. 833 OIL CONDITIONING UNIT, containing features for washing and dehydrating oil, can be used to advantage with Type A filters, and with this unit is said to provide all important factors necessary for complete oil conditioning: precipitation, filtration, acid correction and dehydration. Maker says application is not limited to Type A filters, however, as it may be used successfully with receiving or precipitation tanks. When used with Type A filters it is only necessary to cut a hole in the side of clean oil compartment of the filter and connect piping to the unit. Then steam water and electric line are connected and unit is ready for use. *S F Bowser & Co, Fort Wayne, 5, Indiana.*



NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library up to Date

For Your Convenience

Two business - reply cards are printed here as a part of this insert. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for four to eight pieces, use both attached cards.

2. Be sure to fill one of the eight spaces for each piece you order. This will assure your receiving copies of literature promptly by reducing amount of clerical work in handling your request.

3. When you have filled out one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail. No postage is required.

Example

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co.

Address 318 First Avenue

Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

Please fill out *each section* of the coupon completely, for each bulletin you wish. Coupons not completely filled out will not be handled. These cards void after Dec. 1, 1943.

BOILERS AND ACCESSORIES

1 COATINGS—Saverite Engineering Co, Hoboken, N. J. 4-page pamphlet describes "Serviron", interior boiler and tank coating said to protect metal against corrosion, pitting, rust, and fungus growth.

2 TUBE CLEANERS—Thomas C Wilson, Inc, 21-11 44th Ave, Long Island City, N. Y. 6-page bulletin No. 63 describes Wilson trigger-power cleaners for small heat exchanger tubes with photographs and tables of sizes and dimensions.

3 BOILERS—Babcock & Wilcox Co, 85 Liberty St, New York, N. Y. 40-page booklet on marine boilers includes engineering data of interest to naval architects, chief engineers, marine superintendents and port engineers. Describes the B & W Single-Pass Boiler, Three Pass (Liberty Ship) Boiler, Three-Drum Boiler, etc.

4 REFRACTORY—Lacede-Christy Clay Products, St. Louis, Mo. 6-page chart gives engineering information and uses for line of refractories and refractory specialities. Products included are high temperature cements, coatings, plastics firebrick and insulating firebrick.

ELECTRICAL EQUIPMENT

5 ELECTRIC EQUIPMENT—Square D Co, 6161 Rivard St, Detroit, Mich. Revised bulletin 2500 describes Saflex Distribution Panels with illustrations and charts. Lists all features of the panelboards.

6 TIME RELAYS—Cramer Co, Inc, Centerbrook, Conn. Bulletin 800 on Type TDC time-delay relays points out what they do, their uses, features, construction and time scale and prices.

7 ELECTRICAL EQUIPMENT—Jeffrey Manufacturing Co, Columbus, Ohio. 176-page catalog 750, on electric vibrating equipment, gives description of different parts of vibrating equipment and applications.

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POWER, 330 West 42nd St., New York 9-43

8 ELECTRICAL EQUIPMENT — Westinghouse Electric and Manufacturing Co, Department 7-N-20, East Pittsburgh, Pa. 12-page booklet B-3223 lists special qualities of Hipersil Cores—smaller sizes, lighter weight, wider range of linear response and simplified construction. Also contains charts of application, performance curves and tables showing complete range of core sizes available.

8A MOTORS—Keystone Electric Co, 1226 Ridgely St, Baltimore, 30, Md. 8-page catalog, entitled "Electric Motor Maintenance", illustrates ball bearing motor end bells and gives advantages over oil-lubricated plain sleeve bearings.

HEATING, AIR CONDITIONING AND REFRIGERATION

9 UNIT HEATERS—Carrier Corp, Syracuse, New York. 2-page circular describes Carrier's Five-Way vertical discharge heater and horizontal discharge unit heater. Tells unit heater construction, assembly and installation.

10 WATER HEATERS—American District Steam Co, North Tonawanda, N. Y. 6-page ADSCO bulletin No. 35-75C illustrates and describes horizontal and vertical storage water heaters with U-tube heating elements, including details of construction, sizes, capacities and dimensions, etc.

11 OIL HEATERS—Griscom-Russell Co, 285 Madison Ave, New York, N. Y. 12-page bulletin 1641 "G-Fin Storage Tank Oil Heater", explains construction of the G-Fin elements, graphically shows heater design, and explains different arrangements in which the heater is furnished, and tables of dimensions and ratings.

12 HEAT DIFFUSERS—Carrier Corp, Syracuse, N. Y. 4-page booklet describes Carrier types 46 P, Q and R heat diffusers. Lists standard and industrial speeds and dimensions of different heat diffusers.

13 BLOWERS — Roots Connersville Blower Corp, Connersville, Ind. 20-page bulletin No. 120-B-12 discusses centrifugal blowers and exhausters, with list of applications, advantages, operating characteristics. Also shows sectional views, various control devices and action views of manufacturing and testing operations.

14 BLOWERS—L J Wing Mfg Co, 154 West 14th St, New York, N. Y. Bulletin CO-5, 8-pages, contains illustrated information on Wing Axial Flow Blowers, Types EMD, single stage, and COM, two stage. Emphasizes their adaptability and wide range of uses.

15 COMPRESSED AIR—Logan Engineering Co, 4900 Lawrence Ave, Chicago, Ill. 8-page bulletin No. 543 points out how the Aridifier is said to cut the unnecessarily high maintenance and replacement costs and loss in man-hours due to moisture and dirt in compressed air lines by cleaning and drying compressed air by centrifugal force.

15A COMPRESSORS—Chicago Pneumatic Tool Co, 6 East 44th St, New York, N. Y. 32-page bulletin 726 describes and illustrates Chicago pneumatic Class O-CE 2-stage motor driven compressors. Advantages of their use and typical installation photographs given.

MATERIALS HANDLING

16 ASH CONVEYORS—Hahn Engineering Div, Luria Steel & Trading Corp, 233 Broadway, New York, N. Y. 12-page booklet outlines company's steam-jet ash conveyors sectional storage units and mechanical soot blowers. Photographs and diagrams illustrate special features of equipment.

17 CRANE—Crane Division, Harnischfeger Corp, Milwaukee, Wis. Pocket size manual for men in charge of servicing overhead travelling cranes contains lubricating charts, standard crane operating signals and operation cautions.

MECHANICAL TRANSMISSIONS

18 SHEAVES—Pyott Foundry and Machine Co, 328 N Sangamon St, Chicago, Ill. 12-page booklet on Pyott QD Sheaves describes methods of installing them, charts of dimensions, and list prices.

19 BELTING — Baldwin Belting & Leather Co, 85 Chamber St, New York, N. Y. 20-page booklet "Leather Belting Conservation and Other Engineering Data" describes the proper selection, correct installation and maintenance of leather belts, methods for aligning shafting and pulleys, cleaning and dressing oak-tanned flat leather belting, belt speeds and recommended pulley diameter tables, belting formulas and specifications.

20 SHEAVES—Worthington Pump and Machinery Corp, Harrison, N. J. 15-page bulletin V-1400 B7C describes the features of the sheaves, applications, dimensions and list prices.

21 TRANSMISSION — Reeves Pulley Company, Columbus, Ind. Catalog TR-432, 15 pages, describes and illustrates company's variable speed transmission, with built-in reducer. Presents principle of operation, advantages of speed adjustability and accessibility for lubrication. Book contains composite dimension diagrams, drawings of standard assemblies, hp and speed rating tables, and instructions for their use.

METERS, INSTRUMENTS AND CONTROLS

22 FREQUENCY METERS—JBT Instruments, Inc, 441 Chapel Street, New Haven, Conn. 8-page bulletin describes and illustrates the JBT vibrating-reed frequency meter, its advantages and extensive application on engine-generator sets, in laboratories, central stations, and industrial plants. Lists data on various models with illustrations.

(*Continued on page* 178)

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PERMIT No. 10
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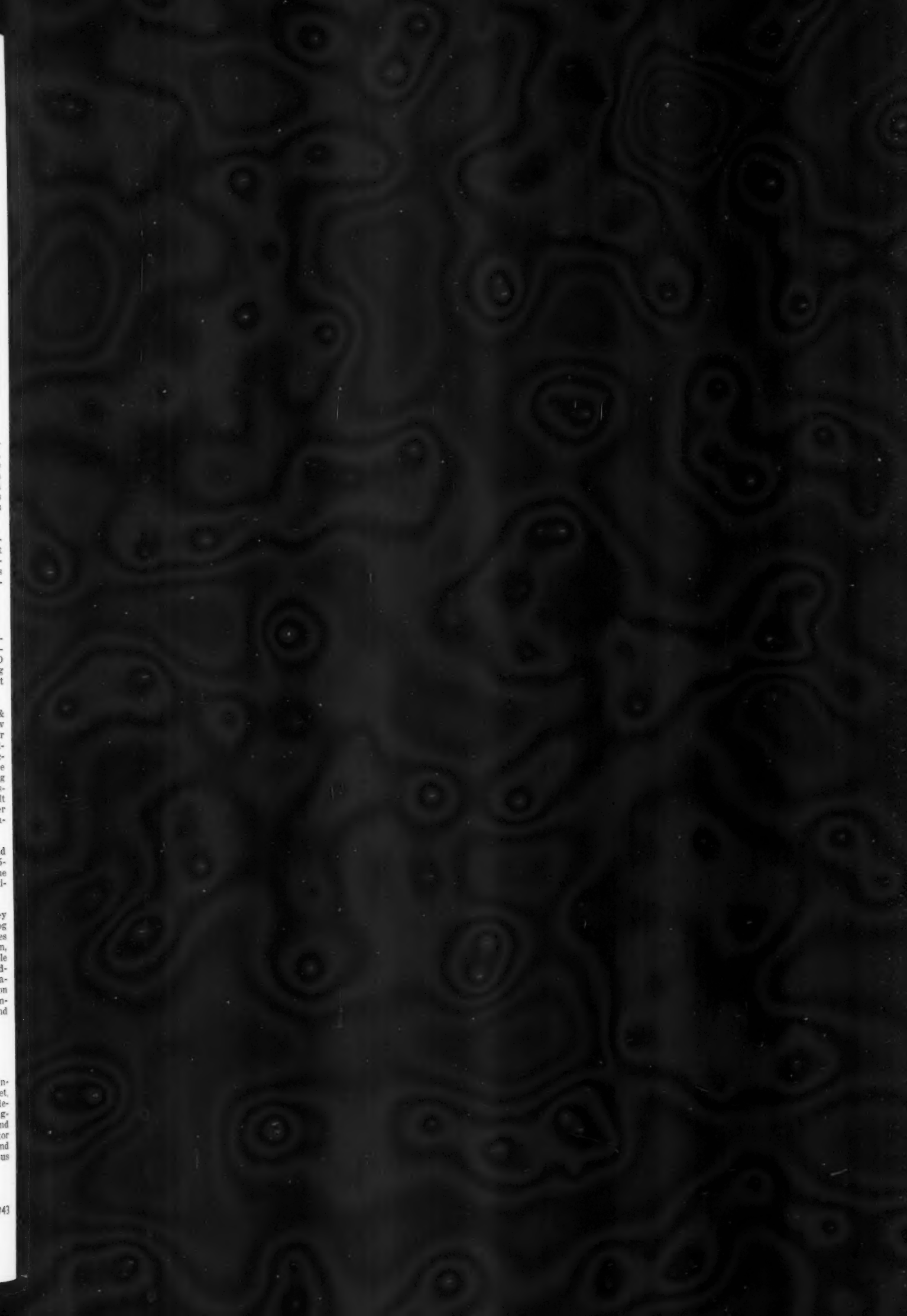
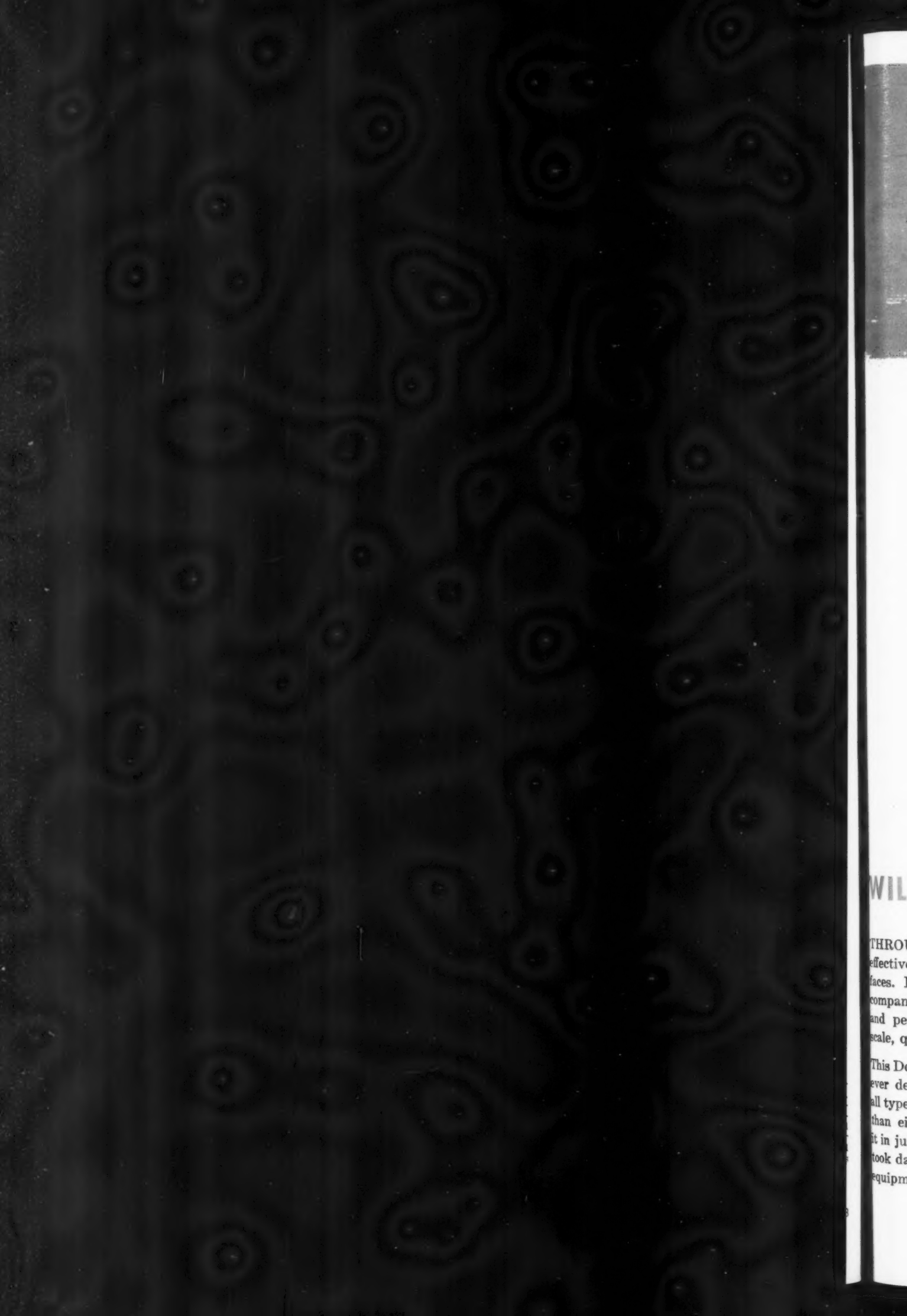
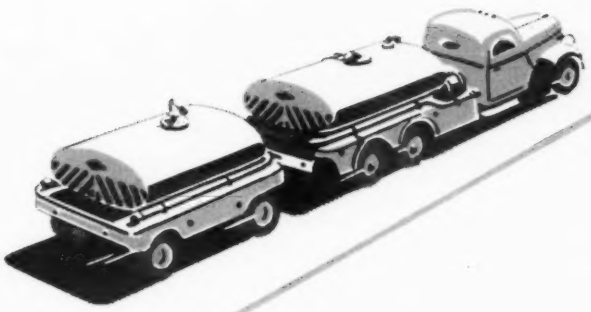






DOWELL CHEMICAL SERVICE

WILL REMOVE THE SCALE *QUICKLY* AND *COMPLETELY*

THROUGH CHEMISTRY has come a better, more effective way of removing scale from heat exchange surfaces. Dowell Incorporated, together with its parent company—The Dow Chemical Company, has developed and perfected a *chemical* method of removing boiler scale, quickly and completely.

This Dowell method is the *fastest, safest* and most *efficient* ever devised for removing water deposited scale from all types of heat exchange surfaces. It does a better job than either mechanical or manual methods and does it in just a few hours where the old-fashioned practices took days. It saves precious time—it keeps vital power equipment operating at peak wartime production.

If you are looking for more boiler capacity and less time off the line—let us give you the complete story about Dowell Chemical Scale Removal Service. Wire, phone or write our general offices in Tulsa—there's no obligation.

DOWELL INCORPORATED
Kennedy Bldg., Tulsa, Oklahoma
Subsidiary of The Dow Chemical Company

Look to
DOWELL
FOR INDUSTRIAL CLEANING AND SCALE REMOVAL SERVICE

SIMPLIFY
PIPE LINE MAINTENANCE
Babbitt *Plastic* Sealants
FOR EVERY SEALING JOB

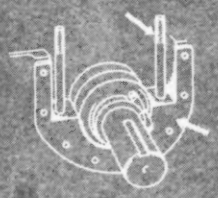
These permanently workable joint and gasket compounds save Time, Labor, Material and Money

Babbitt Plastic Sealants simplify the job of keeping production rolling by speeding pipe repairs, enabling fewer men to handle the maintenance work.

Time and Labor saved: Babbitt Sealants are ready-mixed. They make tight yet remain *permanently workable.* Even long-standing unions take down readily. Readjustment of pipe lines is easy.

Money and Material saved: With Babbitt Sealants no costly time or material is wasted cutting and hammering "cemented" joints. Pipe and fittings disassemble easily, undamaged and in condition for re-use.

Babbitt Plastic Sealants are widely used for extremes in temperature, pressure and vibration, and to seal against water, steam, brine, alcohols, oils, gasolines, gases, commercial acids and other chemicals. Each Babbitt Sealant handles a wide range of application, further simplifying maintenance. Try Babbitt Sealants for better sealing.



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PIPE FLANGES AND BOLTS

GROUND PIPE COUPLINGS

VALVE SEAT INSERTS

LINE Y PLUGS

Send for "The Story of Sealants"— informative, 12-page book describing Babbitt Sealants and their applications

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Sealing Specialists for Industry

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Babbitt
ENGINEERED TO EXACT STANDARDS
Sealants

New Bulletins

(*Continued from page* 176)

23 FLOATS—Chicago Float Works, Inc, 2330 Western Ave, Chicago, 8, Ill. 19-page catalog describes application, construction, shape and connections.

24 METERS—Illinois Testing Laboratories, Inc. 420 North La Salle St, Chicago, Ill. Illustrated pamphlet on exhaust pyrometers shows typical applications and representative installations.

25 FLOWMETERS — Fischer & Porter Co, 960 County Line Road, Hatboro, Pa. Catalog 98-Y "Theory of the Rotameter" describes history and development of area flowmeters. Also gives charts for capacity and size.

26 TEMPERATURE CONTROL INSTRUMENTS—Wheelco Instruments Co, Harrison and Peoria Streets, Chicago, Ill. 16-page Bulletin Z6200 presents features of company's instruments including interchangeability of all component parts, variety of ranges, accessibility of parts, and advantage of uninterrupted operation. Contains data and illustrations of pyrometers, chronotrols, capacitrols, potentiometers, thermocouples, flameotrols, etc, plus tables of models and prices.

27 CONTROLLERS — C J Tagliabue Mfg Co, Park & Nostrand Aves, Brooklyn, N. Y. Catalog No. 1200, 46 pages, presents three types of indicating and recording controllers for temperature and pressure—on-off, throttling and automatic reset. Contains pressure-spring-controller illustrations and installation photographs.

28 TACHOMETERS—Herman H Sticht Co, 27 Park Place, New York, N. Y. 4-page bulletin No. 790 features model "J" hand tachometers in the single-range type, designed for heavy-duty service.

29 CONTROL—R W Cramer Co, Inc, Centerbrook, Conn. Condensed catalog No. 1 describes functions of many different control timers and also lists applications for each timer.

30 TEMPERATURE INSTRUMENTS—Leeds & Northrup Co, 4934 Stenton Avenue, Philadelphia, Pa. Catalog N-33-163, 35 pages, contains data on Micromax temperature recorders for use with thermocouples or with thermoohm resistance thermometer bulbs. Applications to temperature measurement of steam, feed and cooling water, fuel combustion air and flue gas, described in detail. Also describes company's optical pyrometer, principles of the thermocouple and potentiometer, the thermohm and the Wheatstone bridge.

31 PNEUMATIC CONTROL—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia, Pa. Catalog N-OOB, 16 pages, stresses use of Micromax pneumatic control for regulation of pH, conductivity and other conditions, as well as temperature. Controller is described as completely factory-assembled, ready to be connected to valve, thermocouple or other primary element, and to electric power. Also gives standard ranges, dimensions, shipping weight, etc.

32 CONTROLS—Sperry Products, Inc, 1505 Willow Ave, Hoboken, N. J. 8-page bulletin No. 78-D describes Sperry's Exactor hydraulic control. Lists capacity, maintenance, installations and other features of this control.

33 CONTROL—Stets Co, 1440 Broadway, New York, N. Y. Catalog No. 143 on liquid level controllers points out design, quality, action, parts installation and maintenance. Presents types of valve regulators and liquid controllers.

Scovill Tube News

SCOVILL MANUFACTURING COMPANY, Waterbury, Conn.

Factors Affecting War-Time Efficiency of Condenser and Heat Exchanger Tubes

The widespread use of copper and copper alloys in heat exchanging equipment is due in some measure to the many favorable physical properties of these materials, i.e., their ductility, toughness, strength, high thermal conductivity, etc., over a wide range of temperatures and pressures. The excellent corrosion-resistance of the copper alloys under most operating conditions, however, is of major importance in this application. The ability of copper and its alloys to withstand the corrosive action of such media as fresh and salt waters, sewage, hydrogen sulphide, acids, alkalis, etc., is of a high order and has established their value in tube form in contact with corrosive media. They have proved their dependability and economy under such conditions as well as under wide fluctuations of temperature, pressure and velocity of the circulating media.

Serious corrosion of condenser and heat exchanger tube does occur, however, particularly when corrosive conditions are admittedly very severe and such corrosion may result in considerable expense, costly delays and shut-down of equipment. In many cases, no improvement in tube life can be expected under existing conditions; in other cases, however, it has been possible to reduce or retard corrosion materially and obtain improved tube performance either by slight changes in operating conditions, by attention to certain operating details or by a change from one tube alloy to another which is more corrosion-resistant to the particular service conditions. For this reason, an appreciation of the factors which contribute to corrosion of tube materials is often of value to a better understanding of corrosion problems; this knowledge, in turn may be used to advantage in combatting such problems and in improving tube life. The subject is considered of sufficient importance to tube users to warrant discussion of the more important matters pertaining to corrosion problems.

"Service in Manuals" Designed for Scovill Customers Now Freely Available to All War-time Tube Users

The "service in manuals" begun by Scovill years ago to assist customers in choice of alloys to fit specific corrosion and installation conditions, is now proving useful to many war-time firms faced with increasing need to conserve scarce tube metal. You may find in Scovill's "Condenser Tube Booklet" just the information you need — diagrams, formulae, lists of alloys — to make your condenser tubes serve you better and longer. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Conn.

Factors Affecting Tube Life

The service life of condenser and heat exchanger tubes is governed by the following major influences:

1. the composition of the alloy
2. the workmanship and quality of the tubes
3. the conditions of service of the tubes

The most satisfactory tube service and tube performance in a heat exchanger unit is obtained only after a careful consideration of these factors.

The Composition of the Alloy

The nonferrous alloys for heat exchanger service may be grouped into three broad classifications, as follows:

(a) Copper, Phosphorized Copper and Arsenical Copper

(b) Brasses or Copper Zinc alloys, usually containing small percentages of other metals such as Tin, Aluminum, Nickel, Iron, Lead, etc.

(c) Copper Nickel alloys, containing Copper, Nickel and, in some cases, minor amounts of other elements such as Tin, Iron, Manganese, Zinc, etc.

Scovill offers a complete range of tube alloys.

Muntz
Admiralty
Phosphorized Admiralty
Red Brass
Deoxidized Copper
Arsenical Copper
Aluminum Brass
70-30 Copper-Nickel
80-20 Copper-Nickel

Each of these has special characteristics which make it particularly suitable for use under certain conditions.

Scovill can place at your disposal the advice and consultation of men with years of experience in practical tube problems.

A Scovill tube material or method of installation may be of aid to you in obtaining longer tube life.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Air-conditioning ducts in the attic of a large theatre. The Koldboard was applied directly to the duct surface and held in place by 16 gauge wire. All joints sealed with hot asphalt.

Condensation difficulties which occur in low temperature ducts can be eliminated by the use of B-H Koldboard. Made from B-H *Black* Rock-Wool, Koldboard is moisture repellent, chemically stable, and non-combustible—the perfect combination for maximum insulating efficiency. The fibres are felted and bonded together to form flat, semi-rigid blocks.

Effective for temperature ranges from −150° to 300° F it provides ideal low temperature insulation for cold storage rooms, air-conditioning ducts, refrigerators, roof insulation, marine bulk heads, ship hulls, etc. Tests by well-known testing laboratory show that B-H Koldboard has a thermal conductivity of 0.32 BTU/sq. ft./hr./° F at a mean temperature of 75° F.

Send for a generous size sample of B-H Koldboard and copy of current catalog.

BALDWIN-HILL INSULATIONS

BALDWIN-HILL COMPANY

575 KLAGG AVE. • TRENTON 2, N. J.

NEW YORK, N. Y. • CHICAGO, ILL. • KALAMAZOO, MICH. • HUNTINGTON, IND.

34 CONTROLS—Sarco Co, Inc, 475 Fifth Ave, New York, 17, N. Y. 12-page bulletin No. 700 on Sarco cooling controls covers self-operated temperature regulators and mixing valves, to control cooling circuits on internal-combustion engines, compressors, condensers, degreasers, stills, etc. Completely illustrated, including many typical hookups, capacity tables, prices, etc.

35 WATER GAGE—The Reliance Gauge Column Co., 5902 Carnegie Ave, Cleveland, Ohio. Bulletin 434 illustrates and provides complete data on the Reliance Prismatic "Safety Water Gage" for both vertical and inclined installations.

35A CONTROLS—Photoswitch Inc, 77 Broadway, Cambridge, 42, Mass. 4-page bulletin contains operation, typical applications, list prices, and uses of Photoswitch electronic level controls.

35B RECORDER CHARTS — Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia, 44, Pa. 6-page folder N-163(2) describes various kinds of Split Charts, which separate, yet keep parallel, similar records drawn by multiple-point Micromax recorders.

MOTORS

36 MOTORS—General Electric Co, Schenectady, N. Y. 16-page bulletin GEA-1437D describes several gearmotors and indicates various locations where they may be used. It also contains descriptions of the mechanical features of these motors, the electrical characteristics of the polyphase motors which are built into them, and charts showing horsepower-speed ratings.

37 MOTORS — Crocker-Wheeler Electric Mfg Co, Ampere, N. J. 4-page pamphlet describes squirrel cage motors, direct-current motors, shipboard pump motors and shipboard auxiliary generators.

38 MOTORS—Century Electric Co, 1806 Pine St, St. Louis, Mo. 16-page booklet, Form 344A, describes squirrel cage induction polyphase motors. Gives the method of selection and construction.

PIPE, VALVES AND FITTINGS

All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ GASKETS—Goetze Gasket & Packing Co, New Brunswick, N. J. First of a series of technical bulletins describes unique research laboratory and ingenious testing method for determining hitherto unknown factors in gasket engineering. Succeeding issues will treat study of each gasket type individually.

40 STEAM TRAP—W B Connor Engrg Corp, 114 East 32nd St, New York, N. Y. 4-page folder stresses simplicity and efficiency of the improved Corliss valve Ace steam trap. Includes tables of dimensions, sizes and capacities.

41 TRAPS—Strong, Carlisle and Hammond Co, 1392-94 West Third St, Cleveland, Ohio. 24-page booklet tells how to select different types of traps and lists materials and parts.

42 OIL SEALS—Gits Bros Mfg Co, 1846-66 South Kilbourne Ave, Chicago, Ill. 16-page booklet on oil seals points out their application sizes with or without flanges and instructions for mounting.

43 FLEXIBLE HOSE ASSEMBLIES—The Weatherhead Co, Cleveland, Ohio. 7-page booklet lists company products—Valves, fittings, accessories, and flexible hose fittings for automotive, aviation, industrial, marine and refrigeration installations.

How U.S.* untied a knot in a steel mill turbine

IF THERE'S a tougher type of turbine to lubricate than a turbo blower in a steel mill, we haven't heard about it. No wonder one of the country's large steel producers couldn't get turbine oil to last longer than 6 months!

But in November, 1940, this manufacturer filled one of its turbo blowers with the then new Shell Turbo Oil. The phenomenal result is shown at right. After 18,553 hrs. of operation Shell Turbo Oil still shows no signs of deterioration. This performance is the reason Shell Turbo Oil is now used in 14 turbines of this steel company.

For further details on this and other outstanding performances of Shell Turbo Oil call in the Shell man. Or, write Shell Oil Company, Inc., Dept. "C," 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

SHELL TURBO OIL

Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil.

SHELL

* CERTIFIED PROOF OF THE SUPERIOR

OXIDATION STABILITY

OF SHELL TURBO OIL

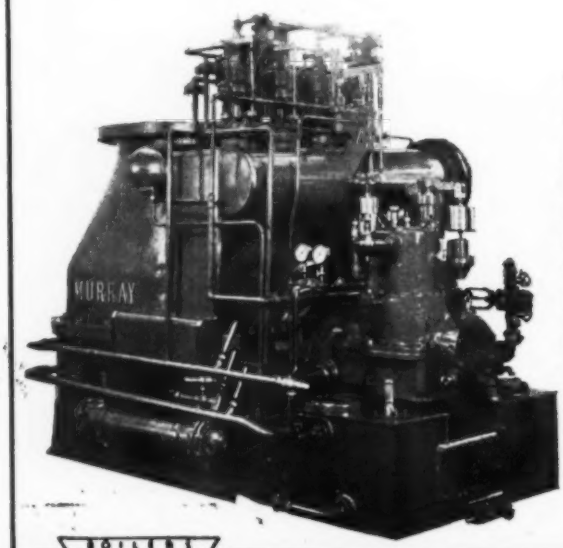
CHARACTERISTICS		
156	Viscosity @ 100° F.	156
Clear	Appearance	Clear
.05	Neutralization No.	.05
.1	Saponification No.	.1
90	Steam Emulsion No.	90

Performance record of Shell Turbo Oil in one of the fourteen units of a large steel producer.

MURRAY TURBINES

for Air Conditioning Compressor Drive

THE illustration below shows one of many MURRAY Turbines designed especially for air conditioning compressor drive. This unit develops 1000 h. p. at 4# initial pressure, 26" vacuum and 4100 r. p. m. It is equipped with variable speed, oil pump, oil relay governor; automatic nozzle control; auxiliary turbine driven starting oil pump; vacuum breaker actuated by overspeed governor; solenoid trip to stop turbine in case of abnormalities in the refrigeration system. Governor includes automatic control which maintains even temperature of the system's cooling medium by varying the capacity of the compressor through the speed. Steam inlet is 12" and exhaust outlet is 36" arranged in an upward direction. Other MURRAY Turbines are driving air conditioning compressor at 8000 r. p. m. or have extraction or extraction mixed pressure gear to maintain the proper heat balance in the plant.



This organization has occupied a prominent place in the steam power equipment field for nearly three-quarters of a century. Thousands of MURRAY Turbines, Engines, and Boilers serving throughout the world reflect the skill that goes into them.

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

44 FITTINGS—Air Reduction Co, 60 East 42nd St, New York, N. Y. 12-page booklet "Pipe Templates for Welded Fittings," tells how to fabricate fittings for welded piping installations by means of flame-cutting and welding. Shows how to draw up and use paper template for flame-cutting pipe to assure accurate, close fitting connections.

45 FITTINGS—Grinnell Co, Providence, R. I. 12-page booklet describes how Superseal tubing service connectors work. Also lists different metals seal can be used with and what fluids it can handle.

46 VALVES—R-S Products Corp, Wayne Junction, Philadelphia, Pa. 4-page illustrated bulletin No. 16-13 contains complete dimension tables for butterfly valves, 15 to 125 psi. Features valves for regulation and shut off duty on air, gas, steam, liquids and semi-solids—manual and automatic control.

47 VALVES—J E Lonergan Co, 2nd & Race Sts, Philadelphia, Pa. 4-page booklet features Lonergan "Valves for Victory" program which inaugurates drive toward new production goals.

48 EXTRACTOR—Reps Tool Co, Inc, 82 Wall St, New York, N. Y. 4-page pamphlet describes pipe and stud extractors. Lists features of the extractors and explains how they work.

49 VALVES — Automatic Temperature Control Co, Inc, Philadelphia, Pa. Catalog A4 covers ATC Type 2 automatic valve operators. Gives tables on limit switch, levers, and ratings. Also included are electrical, force and torque data.

50 FLEXIBLE HOSE—Titeflex Metal Hose Co, 500 Frelinghuysen Ave, Newark, N. J. Catalog No. 112 describes flexible tubing used with oil, gas and liquid. Complete data given on available fittings, both industrial and SAE. Also includes pressure charts, charts showing radius of bend, and many other essential data. Usual and unusual types of applications for flexible metal tubing are pictured and described, together with instructions for installation.

51 VALVES—Cooper Bessemer Corp, Mt. Vernon, Ohio. Folder describes valve seat grinding equipment and accessories for maintenance of Cooper-Bessemer engines.

52 PIPELINE FILTERS — American Locomotive Co, Alco Products Div, 30 Church St, New York, N. Y. Bulletin 1033, five pages, presents features and advantages of Alco pipeline filters, emphasizing ease of cleaning and refilling, non-restricted openings, and reduction in weight. Contains detailed diagram of filter, and illustrations of various filters, and of fabricated and pre-fabricated piping.

52A VALVE SEATS AND TOOLS—Economy Valve Seat Co, 2617 Fletcher St, Chicago, Ill. 4-page circular describes Economy renewable seats and reseating tools for valves, faucets, bibbs, etc, giving simple directions for reseating a faucet.

PRIME MOVERS AND EQUIPMENT

53 SOLVENTS—Wil-Co-Lene Chemical Co, Newark, N. J. Leaflets present advantages of Wil-Co-Lene Diesel and Auto Engine Solvent for internal-combustion engines. Also give data on company's fuel oil solvent which is said to prevent the accumulation of sludge, prevent inside rust, and save fuel; also information on soot remover.

54 PISTON RINGS—Cooktite Ring Sales Co, 1737 Howard Ave, Chicago, Ill. Bulletin No. 400, 4 pages, discusses Cook's graphitic iron piston rings, material, surface treatment, design, and workmanship. Also contains photographs and diagrams.

METALLIC AND FIBROUS PACKINGS
FOR EVERY PURPOSE

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.
FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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Detroit, Michigan	200 East Illinois Street
Houston, Texas	4 West 7th Street
Kansas City, Missouri	169 West Jefferson Avenue
Los Angeles, California	509 Washington Avenue
Montreal, Canada	1332 Oak Street
Milwaukee, Wisconsin	720 Mateo Street
New Orleans, Louisiana	5575 Cote Saint Paul Road
New York, New York	4417 West North Avenue
Philadelphia, Pennsylvania	418 Common Street
Pittsburgh, Pennsylvania	100 Sixth Avenue, near Canal
Portland, Oregon	401 North Broad Street
San Francisco, California	405 Penn Avenue
Seattle, Washington	Terminal Sales Building
St. Louis, Missouri	2207 First Avenue, South
Tulsa, Oklahoma	156 South Park
Wilmington, California	1407 Pine Street
	823 South Gary Place
	207 Avalon Boulevard

Unequaled Flow Characteristics Low Pressure Loss and Maintenance

36-inch valve with welding end, carbon-moly body and four to six per cent chrome-moly vane. Equipped with alloy shafts and bushings, finned lubricated stuffing box and hydraulic cylinder with positioner. The auxiliary heavy duty hand wheel control is equipped with self-locking worm and gear and declutching unit.

Standard 125 lb hand lever operated valve. Can be equipped with hand wheel, chain lever or chain wheel. An extension shaft is provided for inaccessible locations.

15 to 900 psi
for air, gas, steam, liquids and semi-solids

A glance at the design of an R-S Butterfly Valve indicates that there is practically no restriction to the flow. The carefully-machined body bore and streamlined vane offer minimum resistance. In fact, the flow conditions are similar to those produced in a venturi tube with high pressure recovery on the downstream side.

It is apparent that the pressure loss in a wide open R-S Butterfly Valve is considerably less than in most conventional types of wedge gates. Add to this the fact that there are no pockets to collect sediment. When the vane approaches a closed position, the valve tends to clean itself.

Shut-off is accomplished by the beveled vane which wedges tight against the valve body. Four to six revolutions of a hand wheel completely open or close the valve vane. Accurate control and shut-off by hand or automatic equipment is a simple matter.

Where hard wear and severe stresses are encountered, the use of R-S "A" metal will produce outstanding results and increased service. Specify R-S Butterfly Valves for reduced maintenance.

Catalog No. 16-B contains detailed specifications. Write for your copy.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Avenue • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

55 SURFACE CONDENSERS — Ingersoll-Rand Co, 11 Broadway, New York, N. Y. 36-page bulletin with 70 illustrations, including cross-sectional views, discusses structure and design features, steam penetration, air removal equipment, marine condensers, etc.

56 TUBING—Formed Steel Tube Institute, 1621 Euclid Ave, Cleveland, Ohio. 20-page booklet gives complete information on welded heat exchanger tubing. Also includes discussion of method used to identify each welded tube.

57 TURBINES — General Electric Co, Schenectady, N. Y. 20-page catalog, No. GEA-1145D, covers Type D mechanical-drive turbines with photographs and diagrams illustrating construction features and general specifications. Also furnishes dimensions and typical installation photographs.

PUMPS

58 PUMPS — Ingersoll-Rand Co, 11 Broadway, New York, N. Y. 20-page descriptive booklet, Form 7073, on vertical axial and mixed-flow pumps designed for large volumes of liquid at low heads. They are suitable for condenser circulating, mine and general sump drainage, dry-dock dewatering, process work, bulk liquid transfer, irrigation, flood control, refinery processes, etc. Contains illustrations and sectional views revealing design and construction.

59 GAS PUMPS — Roots-Connersville Blower Corp, Connersville, Indiana. Bulletin 31-B115, 5 pages, describes Victor-Acme positive displacement gas pumps, explaining advantages in construction, wide range of industrial application. Contains selection table, sectional views, and photographs of models, and examples of V-A gas pumps incorporated into specialized equipment.

60 PUMPS—The J S Coffin, Jr Co, Englewood, N. J. Bulletin 1-22 describes Coffin steam turbine centrifugal pumps and the advantages of their design. Explains, with illustrations and detailed diagrams, the rotating unit, operating reliability, and the five types of pumps, plus tables of their standard specifications.

61 PUMPS — Watson-Stillman, Roselle, N. J. Bulletin 260-A describes vertical pumps. Describes construction and materials, pump speed, tank capacity, pipe connection and floor space.

62 PUMPS—D W Haering & Co, Inc, 205 West Wacker Drive, Chicago, Ill. 8-page bulletin describes latest developments in proportioning and sampling equipment. Construction, operation and application of the Nelson chemical proportioning pump are discussed.

63 PUMPS AND HYDRAULIC EQUIPMENT—Aldrich Pump Co, Allentown, Pa. Catalog 100, 16 pages, describes and illustrates representative pumps and hydraulic equipment for power plants, oil fields, process industries and marine use. Company offers engineering service.

WATER TREATMENT

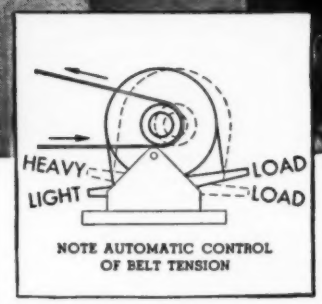
64 BOILER WATER CONDITIONING —Elgin Softener Corp, Elgin, Illinois. 15-page bulletin No. 504 covers boiler water conditioning; explains types of impurities in boiler feedwater and how they accumulate; causes of boiler scale, sludge, corrosion and carryover. Describes Elgin Deconcentrator.

65 FILTERS—Air-Maze Corp, 5200 Harvard Ave, Cleveland, Ohio. 4-page catalog describes the Air-Maze line of breather-filters. Gives a chart on types, sizes, dimensions and weights.

66 FILTERS—Cuno Engineering Corp, Meriden, Conn. 32-page booklet describes and illustrates Cuno Filter in-

Belt Life QUADRUPLED

through a $51.70 investment . . .



NOTE AUTOMATIC CONTROL OF BELT TENSION

● The rubber V-belts shown above were condemned as unfit over four years ago . . . yet they are running in good condition today! What's the answer?

This manufacturer had belt-stretch trouble from the moment he installed this big 12 x 11 air compressor. Monthly belt adjustments were necessary. No belts lasted over a year.

In '39, instead of buying a new set of belts, he installed an *American Econ-o-matic Drive* . . . putting on the same old set of "condemned" belts. This same old set of belts has been driving the compressor ever since without a bit of attention! No more monthly belt take-ups needed. No more shutdowns due to maintenance. With a drive investment of $51.70, this manufacturer has already saved over $400 in belt costs alone!

The load governs belt tension with an American Econ-o-matic Drive!

Here is the heart of the Econ-o-matic Drive—the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the load on the motor. When load is heavy, belt is automatically tightened. When load is light, belt is automatically loosened. There's never more tension on the belt than the load requires. No slide rails or idlers to adjust! Whether Short-Center Flat-belt or V-belt type—American Econ-o-matic Drives give you these advantages:

- Longer life for belts and bearings
- No belt slip—no lost R.P.M.
- Maintenance man-hours greatly reduced
- Smooth, cushioned starting
- Increased machine output
- Substantial power savings

Navy "E" for excellence awarded Feb. 12, 1942.

Send for this new Econ-o-matic Handbook

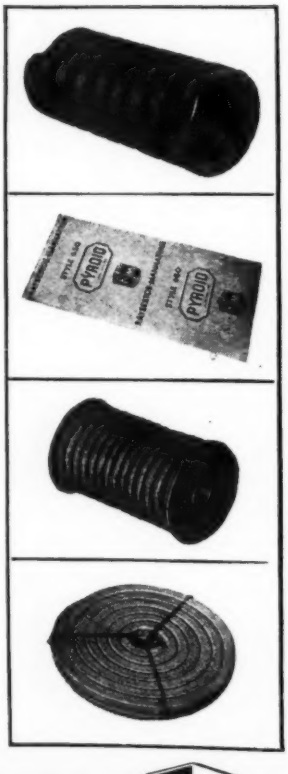
It gives you complete drive data, solves drive maintenance problems and shows how to select the right drive for your purpose. Write now.

The American Pulley Company
4206 WISSAHICKON AVE., PHILADELPHIA, PA.

WHEN R/M PACKS 'EM THEY STAY PACKED!

Bigger loads to carry are the order of the day. Terrific pressure is on, all down the line. R/M Packings are built to stand up under this added strain — to keep steam, fuel, oil, and air on the job night and day.

R/M manufactures every type of packing for use under almost every conceivable service condition. You'll find the practical answer to your packing problems in the R/M catalog. See your local R/M distributor or write direct.



ARMY E NAVY

Awarded to R/M
North Charleston Plant

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MANHEIM, PA.
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stallations with photographs, sectional views and diagrams. Presents application, principles of operation, and solves filtration problems for varied machines and equipment.

67 SOFTENERS—Cochrane Corp, 17th & Allegheny Ave, Philadelphia, 32, Pa. Bulletin 4021 describes the many uses and applications of the new carbonaceous zeolite softeners. Also lists the chemical reactions and general arrangement of the equipment, the results to be achieved and application to different water supplies.

WELDING

68 ARC-WELDING ACCESSORIES — General Electric Co, Schenectady, N. Y. 38-page bulletin GEA-2704C features the full line of GE chrome leather, asbestos, and flameproofed duck protective clothing for both men and women. Also listed are standard sets of welding accessories and renewal parts for these accessories.

OTHER EQUIPMENT

All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ SAFETY — Mine Safety Appliance Co, Pittsburgh, Pa. 32-page handbook entitled "How to Make Your Safety Equipment Last Longer" covers every type of personal safety equipment, from protective hats, gas masks, respirators and gas instruments through the list to safety clothing. Illustrated throughout by marginal drawings pertinent to the text.

69 COATINGS—Quigley Co, 56 W 45th St, New York, N. Y. Six-page booklet No. 376 details properties of Triple-A protective coatings for protecting plants and all metal structures and equipment against rust and corrosion. Photomicrographs show comparisons of interest to prospective user.

70 LIGHT UNITS — Reliance Devices Co, 510 Sixth Ave, New York, N. Y. Catalog No. 102, 4 pages, outlines Swivelier Work-Lite units which are said to be universally adjustable, unaffected by machine vibration, stay at any angle and require no screws or wing nuts for adjustment.

71 TOOL MAINTENANCE — Independent Pneumatic Tool Co, 600 West Jackson Blvd, Chicago, Ill. 20-page booklet No. JE-199 contains complete and brief instructions on proper operation and care of all types of portable electric tools. Special attention is given to more common and simple problems in connection with maintenance of motor, cable, switch and brushes.

72 COATINGS—United Chromium Inc, 51 East 42nd St, New York, N. Y. 8-page booklet "Ucilon" describes what this coating is, how it was developed, who specifies it and what material it resists. Gives properties of Ucilon and the industries in which it finds use.

73 WHITE PRINTS—Ozalid Products Division, General Aniline and Film Corp, Johnson City, N. Y. Pamphlet describes whiteprints and what they are used for, with advantages listed.

74 LUBRICANTS — Keystone Lubricating Co, 21st, Clearfield and Lippincott Sts, Philadelphia, Pa. Pamphlet on treatment and lubrication of wire cable gives the qualities of the lubricant and tells what the wire cable treatment is. Also lists the applications.

Can you get each of your employes to BUY AN EXTRA $100 BOND in September?

That's the problem.

That's the job of the Third War Loan.

The objective is to raise fifteen billion dollars. No one ever set out to raise fifteen billion dollars at one time before in all the history of the world. To raise that kind of money, you have to go where the money is . . . the idle money.

72% of all the *idle* money is estimated to be in the hands of people who work for wages.

They are the employes on your *payroll* and the employes on other business men's *payrolls*.

You are the quickest, most direct route to those millions of men and women.

You know them.

You have access to them.

They are *your* particular *prospects*.

If you can get each of them to buy at least one extra $100 war bond (price: $75), in addition to their regular payroll deduction purchases, the Third War Loan will be a success.

We are listing below some of the things you can do to help sell an extra bond to each one.

Will you do them?

HERE'S HOW TO DO IT!

This brief outline was prepared expressly for your use by a nationally-known firm which recently directed a successful war bond selling drive among a large group of Koppers employes.

You have undoubtedly served on some money-raising campaign in your city . . . for your favorite hospital, or community fund, or Red Cross.

You know how those campaigns are organized.

Organize one in your own plant or plants for the Third War Loan.

1. Appoint a campaign committee, or have the labor-management committee appoint one.

2. Head it up with a chairman who is aggressive and a go-getter.

3. Have committees set up for each shop or each department. Organize them as teams, to compete with each other. Americans love competition . . . we love to make a game of our work. Appoint leaders for all committees and give them military titles.

4. Appoint a campaign manager who can devote full time to the campaign until you reach your goal.

5. Start with a big rally. Get your local Army or Navy office to send officers and men to take part in the rally, or have a returned war hero appear, for morale purposes. If you are working on war work make some special shipment as part of that rally.

6. Put up exhibits and posters around the plant which you can get from your local War Loan headquarters.

7. Have a bulletin board on which you can post daily the *percentage* of employes who have signed up in each department or on each team.

8. Have some newspaper publicity about what you are doing. It will encourage your people and will help the company, too. Tell the publicity director of your local War Bond campaign what you are doing.

9. Where employes are unable to afford a $75 expenditure for a $100 war bond, encourage them and members of their families to sell war stamps to their friends and neighbors and credit these sales against the team total.

10. End the campaign with a rally and honors or prizes for the biggest producers or hardest workers.

KOPPERS COMPANY AND AFFILIATES, PITTSBURGH, PA.

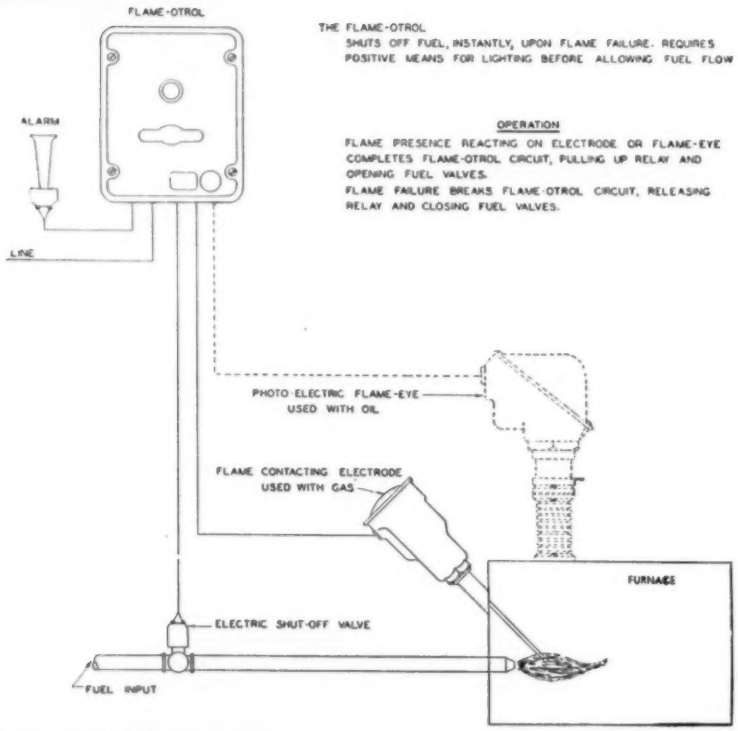
KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

You can prevent

COMBUSTION EXPLOSIONS

. . . . regardless of fuel burned


FLAME-OTROL
THE FLAME-OTROL
SHUTS OFF FUEL, INSTANTLY, UPON FLAME FAILURE. REQUIRES POSITIVE MEANS FOR LIGHTING BEFORE ALLOWING FUEL FLOW
OPERATION
FLAME PRESENCE REACTING ON ELECTRODE OR FLAME-EYE COMPLETES FLAME-OTROL CIRCUIT, PULLING UP RELAY AND OPENING FUEL VALVES.
FLAME FAILURE BREAKS FLAME-OTROL CIRCUIT, RELEASING RELAY AND CLOSING FUEL VALVES.
ALARM
LINE
PHOTO ELECTRIC FLAME-EYE USED WITH OIL
FLAME CONTACTING ELECTRODE USED WITH GAS
FURNACE
ELECTRIC SHUT-OFF VALVE
FUEL INPUT

The Wheelco FLAME-OTROL

—provides instantaneous shut-off of fuel supply in case of flame failure. The Flame-otrol operates with equal efficiency on gas, oil, powdered coal or any combination of these fuels. It is approved by both the Underwriters' Laboratories and the Associated Factory Mutual Laboratories. The FLAME-OTROL is available with automatic or manual ignition, time delay for purging, or any other sequence of operation desired.

Bulletin L2 gives complete information. Request your FREE copy TODAY!

Wheelco Instruments Co.

863 W. HARRISON STREET • • • CHICAGO 7, ILLINOIS

Originator of "Electronic Principle" Temperature Controls

75 CLAMPS—National Production Co, 4561 St Jean Ave, Detroit, Mich. Pamphlet describes the wire rope clamp and compares the old way of looping wire cable and new wire clamp.

76 PRINTS—Paragon-Revolute Corp, 77 South Ave, Rochester, N. Y. 40-page booklet describes print making and processing. Lists uses for blueprints, sepia negatives, direct process prints, reproduced tracings, continuous yardage and cut sheets.

77 STEEL FLOORING—Kerlow Steel Flooring Co, 222 Culver Ave, Jersey City, N. J. Catalog MC43 "Industry's Magic Carpet" features large illustrations showing the proportions and construction of many different designs of open steel flooring in a large variety of industries.

78 SKIN PROTECTOR—Alexite Engrg Co, Colorado Springs, Colo. Folder describes Alexite skin protector, said to be easy to apply and remove, and also said to protect workers from dermatitis. Product forms a barrier against skin absorption of water, oil or grease-carried irritants.

79 SYNTHETIC RUBBER—B F Goodrich Co, Akron, Ohio. Revised edition of catalog section on "The Properties of Ameripol D", its oil- and heat-resisting synthetic rubber, discusses properties, including resistance to various substances which are enemies of natural rubber, hardness, tensile strength, elongation, weight, color, odor and taste, elasticity and permanent set.

80 LUBRICATION — Acheson Colloids Corp, Port Huron, Michigan. 4-page bulletin presents "dag" colloidal graphite as a high temperature lubricant. Discusses typical applications, limitations of liquid lubricants. Offers case study information on use of this material for foundry oven conveyors, kiln cars, hot punches and piercing tools, forging dies.

81 SYNTHETIC RUBBER — United States Rubber Co, 1230 Sixth Avenue, Rockefeller Center, New York. 40-page booklet contains information on the history of synthetic rubber, and comparative properties of natural and synthetic rubber. Deals with thermoplasticity, molecules, hydrocarbons, substitution, saturation, polymerization and vulcanization. Instructive data on five types of synthetic rubber, Buna S, and its method of manufacture; Buna N, the Neoprene, Butyl Rubber, the Thiokols, and their relative advantages. Book contains photographs, molecular structure diagrams, and glossary.

82 SHEARS — Watson-Stillman Co, Roselle, N. J. Bulletin 740-A lists the different types of wire rope shears for round and flat idon bars and cable.

83 FLUORESCENT FIXTURES — Mitchell Mfg Co, Chicago, Ill. Catalog No. 400 introduces new Mitchelite line of fluorescent fixtures. Ilustrates and explains features: new design and construction, no waste steel, non-metallic reflector, accessories for every type mounting, compliance with WPB and U. S. Bureau of Standards, etc. Contains graphs, tables, and charts to help solve every lighting problem and simplify selection of proper fixtures for each job.

84 TOOLS—H K Porter, Inc, Everett, Mass. 48-page booklet deals with care and repair of bolt and wire cutters, lists various types and hardnesses, explains correct cutting technique, lubrication, adjustment of cutting edges. Also contains data on other common tools and tables of their designation, dimension, weight, capacities, and list prices.

85 MANGANESE STEEL — American Brake Shoe Co, Chicago Heights, Ill. 48-page bulletin No. 543-G on man-

NEVER BEFORE SUCH GREAT "DUCTILE STRENGTH" and DURABILITY in

85% MAGNESIA HEAT INSULATING MATERIAL!

Coupling new strength with unprecedented light weight and lower thermal conductivity, Plant *Precision Molded* 85% Magnesia pioneers brand new standards of heat-insulation performance.

Just as engineers can depend upon Plant *Precision Molded* 85% Magnesia for greater savings in fuel and heat, so applicators can look to this new product for speedier, easier installation, thanks to such new features as precision pipe fit, clean, smooth finish, and controlled uniformity.

The new, revolutionary, patented* Plant *Precision Molded* process is the first to capitalize fully upon the superiority inherent in 85% Magnesia. The facts about this new standard of dependability in 85% Magnesia belong in every engineer's file. Write now for descriptive data.

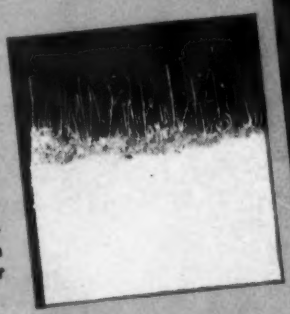
B-R-E-A-K it

SEE HOW IT HOLDS TOGETHER!

No wonder Plant *Precision Molded* 85% Magnesia stands up better under vibrating service! No wonder it resists shocks from shipping, accidental dropping and rough handling during installation! The Plant *Precision Molded* process builds new "Ductile Strength" right into the product!

CLOSE-UP REVEALS SECRET!

Note that the greater number of asbestos fibres run longitudinally. This is accomplished by orientation of fibres during manufacture, which controls fibre direction and imparts greater "ductile strength."



KEEPS ITS SHAPE!

Doesn't "mush" if accidentally wetted—retains normal structure after drying! Under most conditions, it can be removed and reused if desired!

Buy more WAR BONDS

PLANT
PRECISION MOLDED
REG. U. S. PAT. OFF.
85% MAGNESIA
"THE DEPENDABLE STANDARD—MODERNIZED"

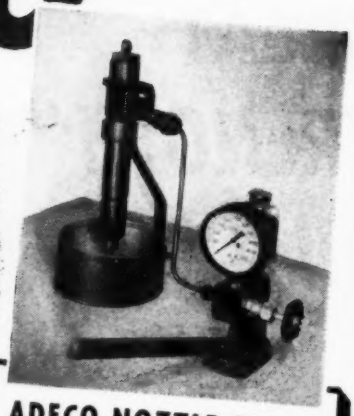
*U. S. Patent Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754

PLANT
RUBBER & ASBESTOS WORKS
Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

MAIN OFFICE: SAN FRANCISCO
Sales Offices in Los Angeles, Wilmington, and Oakland, Calif.; distributors in principal cities.
Factories in Emeryville, San Francisco, and Redwood City, Calif.

ADECO

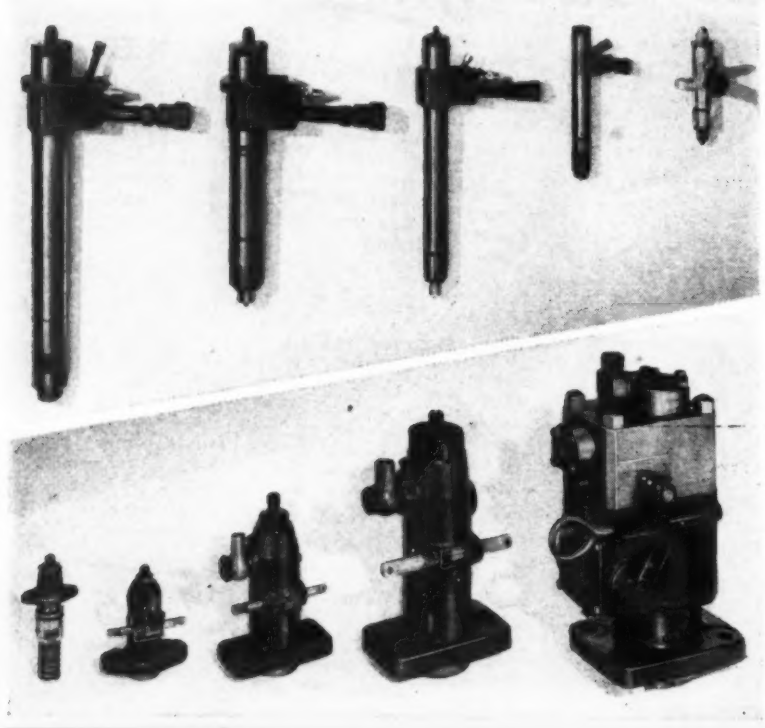
DEPENDABLE
DIESEL FUEL
INJECTION EQUIPMENT



ADECO NOZZLE TESTER
For Economical Maintenance

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Best for economical maintenance. Write for new bulletin.

Throughout the diesel industry, Adeco stands for the finest in fuel injection equipment. Years of experience in pioneering equipment for America's diesel needs have resulted in an outstanding line of fuel injection pumps, nozzles and nozzle holders. Today's performance of this dependable equipment merits your confidence for tomorrow's requirements.



AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 North Ravenswood Avenue • • Chicago, Illinois

ganese steel for general industry tells what it is, properties and applications.

86 JOINTS — Brooks Equipment Corp, 90 West St, New York. 47-page booklet "Beco Shaft Joints and Assemblies" describes the different types of joints and brackets that the company makes. It also gives the assemblies for these joints and tables of information and capacities along with prices for all types.

87 STEEL FLOORING—Walter Bates Co, Joliet, Ill. 16-page catalog No. 43–44 gives tables of load capacities and standard installation of treads of various widths.

88 TRAINING—B F Goodrich Co, Akron, Ohio. 26-page manual outlining all details of the various courses of study conducted by Apprentice School. Explanation of school's purpose, method of selecting students, administration of the program, cooperative plan with the local board of education, ratio of apprentices to journeymen, and length of time required in each of the courses. The course of study for each trade is given, both in the classroom and in the shop and number of hours required in each.

89 COATINGS — The Sterling Varnish Co, 165 Ohio River Blvd, Haysville, Pa. Bulletin 143 "Thermobonds, The New Installation," describes ten insulating mediums in their separate applications such as high speed armatures, high cycle drill and grinder motors, heavy duty motors and transformers and marine engine magneto coils.

90 VARNISH—John C Dolph Co, 168 Emmett St, Newark, 5, N. J. Pamphlet contains specifications of Synthite PG-1 clear baking varnish. Also gives method of insulating units and vacuum impregnation.

Power Lines

(*Continued from page* 134)

mittee, through *Popular Photography* magazine, is conducting a photographic contest illustrating heavy, dormant industrial scrap collections. Closing date of the contest is Oct 31, 1943. For further information write the Business Press Industrial Scrap Committee, 50 Rockefeller Plaza, New York, N. Y.

OBITUARIES

George F West, builder and operator of utilities in half a dozen states, died July 12 at the age of 80.

George E Andrews, 69, an adviser for the Technical Publishing Co, died July 16, 1943. Mr Andrews was born in Newfield, N. H., was educated at Phillips Exeter Academy and Connecticut Wesleyan University. At one time Mr Andrews was business manager of POWER.

William E Doll, 54, president of the Gustavo Preston Co, Boston, died at his home in Swampscott, Mass., July 22. The Gustavo Preston Co is New Eng-

FOR EVERY OIL MAINTENANCE APPLICATION

Briggs Engineers have designed a line of oil clarifying equipment vitally essential to war and peacetime operations. Incorporated in each individual design is the specialized experience of men who have devoted a lifetime to this problem.

Thousands of installations on industries' stationary engines—thousands of marine and automotive applications — are operating continuously, efficiently and economically. Now ... Clarifiers for insulating oils, machine tools, and aviation applications are available.

Bonded blocks of Fullers Earth and layers of Cellulose, made into a compact refill cartridge accomplish complete clarification. Engineered to ADsorb sludge forming acids and other soluble impurities, Briggs Oil Clarifiers go a step beyond many oil filters which stop after removal of solid particles. This extra cleansing keeps oil "refinery pure" . . . protects engines . . . reduces maintenance costs.

BRIGGS Clarifier CO.

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Coal Handled at Low Cost

with a simple SAUERMAN SCRAPER installation

Engineers and superintendents of power plants large and small where coal is being store and reclaimed with SAUERMAN Power Scrapers say that this equipment is giving them a maximum of satisfaction.

These machines operate rapidly and economically—handling coal into and out of storage in whatever quantities are needed. Coal is stacked layer on layer to any height. This method of storing produces a pile that is perfectly homogeneous and safe from the menace of spontaneous combustion.

The operator is housed in a comfortable control station where he has a view of the entire storage area. The operation is automatic except that a few minutes of manual labor is required to change the operation from storing to reclaiming, or vice versa. Repair demands are few and far between. *Write for free 50-page Manual.*

SAUERMAN BROS., Inc.

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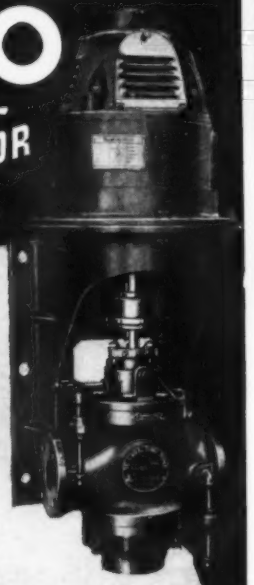
IMO Serves STEAM OR DIESEL

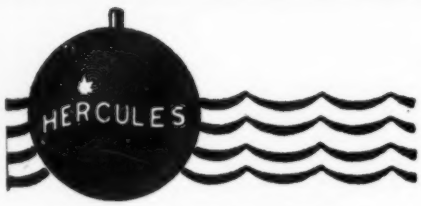


This De Laval-IMO fuel-oil transfer pump is installed on a Diesel-driven C-2 cargo vessel. On steamships De Laval-IMO pumps supply oil at high pressure to burners. De Laval-IMO pumps circulate "lube" oil on both motorships and steamships. IMO pumps handle any quantity of any oil against any pressure. They have only three moving parts, no valves, no gears and no cams, are free from vibration and pulsation and can be coupled directly to standard speed motors or turbines.

Ask for Publication I-110

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process, Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

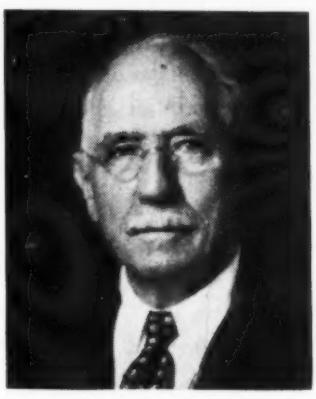
land's representative of several large companies.

Frederick S Freeman, 62, superintendent of power for the Boston Elevated Railway since 1919, died at Brookline, Mass., July 17. He was born in Brookfield, N. S., and in his earlier career was connected with the Boston Edison Co, Brooklyn Rapid Transit Co, and was chief engineer of the Alpha Portland Cement Co in Pennsylvania. He joined the Boston Elevated in 1907, was made chief engineer of its Dorchester power station in 1908, and chief engineer of power operations in 1913.

Robert S Weston, 73, distinguished consulting engineer in the fields of water supply and sanitation, and a member of the firm of Weston & Sampson, Boston, died suddenly at Wakefield, R. I., July 29.

Albert Kingsbury, 80, founder and president of the Kingsbury Machine Works, Philadelphia, died July 28. He had been a professor of mechanical engineering and was noted as the inventor of the Kingsbury thrust bearing used in warship and steamship driving shafts, land and marine turbines.

Mr Kingsbury became associated in 1903 with the Westinghouse Electric and Manufacturing Company plant at East Pittsburgh, Pa. He remained there until 1910. He passed the next few years perfecting his invention, and in 1918 founded the Kingsbury Machine Works. The company was incorporated



in 1925 and Mr Kingsbury named president.

Mr Kingsbury was a Fellow of the American Association for the Advancement of Science; a member of the American Society of Mechanical Engineers and an associate member of the American Institute of Electrical Engineers. He held many professional honors, including the John Scott Medal of the City of Philadelphia and the Elliott Cresson Medal of the Franklin Institute.

REPORTING *on the use of*

Linde Methods

in mass production..

SHIPBUILDING . . . A typical major industry where Linde methods speed production

Building the Victory Fleet faster than ships ever were built before . . . 16,000,000 tons of merchant shipping alone this year . . . requires mass-production methods using the most efficient processes available. Some of the most essential of these processes were developed by The Linde Air Products Company . . . developed to meet peacetime requirements . . . and adapted with Linde engineering help to meet the specialized mass-production needs of today.

As you turn this page, you will see how some of these Linde techniques are being used to speed production and save precious time and materials in shipbuilding . . . both in the yards and the outfitting docks and even in the mills making ship steel.

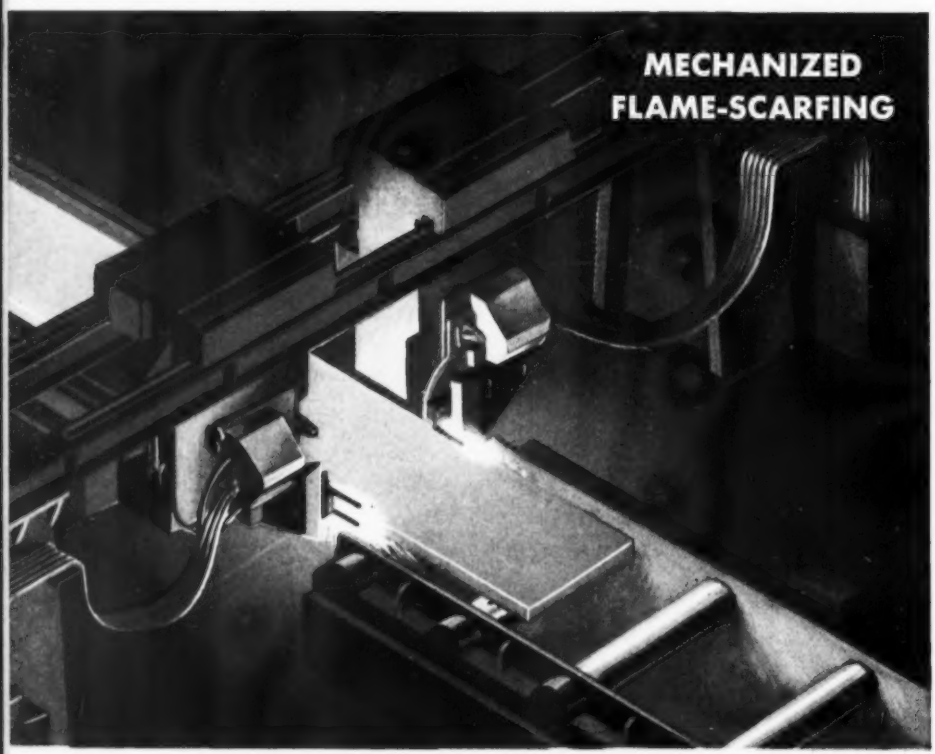
The shipbuilding industry is but one of many that are applying Linde's oxy-acetylene techniques . . . and Unionmelt electric welding . . . to specialized mass-production. Wherever metals are cut, formed, joined, or treated in essential industries, Linde developments are helping to do the job faster, better, and more economically. Every ton of steel produced and fabricated, as well as every ship constructed . . . calls for use of oxygen and acetylene and oxy-acetylene apparatus in increased quantities.

When you realize this, you will appreciate the importance of using productively . . . without waste . . . all supplies for these metal-working methods.

From STEEL to SHIPS Linde Methods

speed production and save precious materials

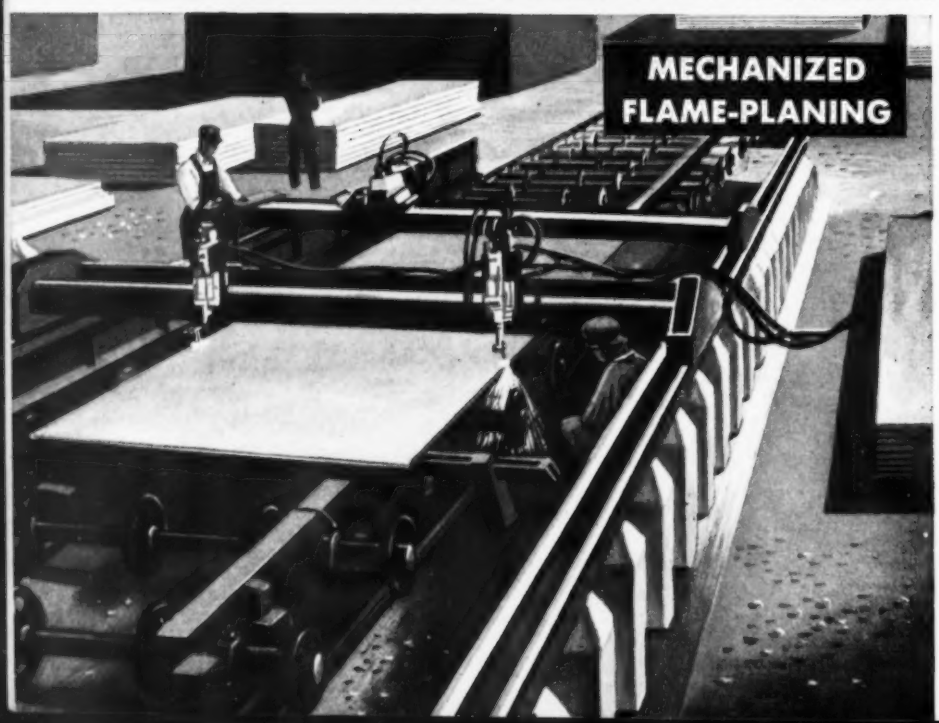
The operations shown here suggest the extent to which Linde's oxy-acetylene metalworking methods have been mechanized. As you give thought to more extensive use of these Linde developments to save time and materials in your own business operations, remember the present need for using every foot of gas only where it will do the most good.



IN MAKING QUALITY STEEL

The removal of surface defects from semifinished steel to produce a higher yield of quality steel once entailed removing the hot steel from the production line . . . allowing it to cool . . . treating it to make surface defects visible . . . laboriously grinding or cutting out these defects . . . and then reheating the steel for further processing.

Today, through use of Linde-developed equipment like that shown here, such time-consuming steps are eliminated. Mechanized batteries of oxy-acetylene blowpipes located right on the roll tables literally "skin" faulty surfaces from the hot steel . . . and higher yields of quality steel are obtained without interruption of production.



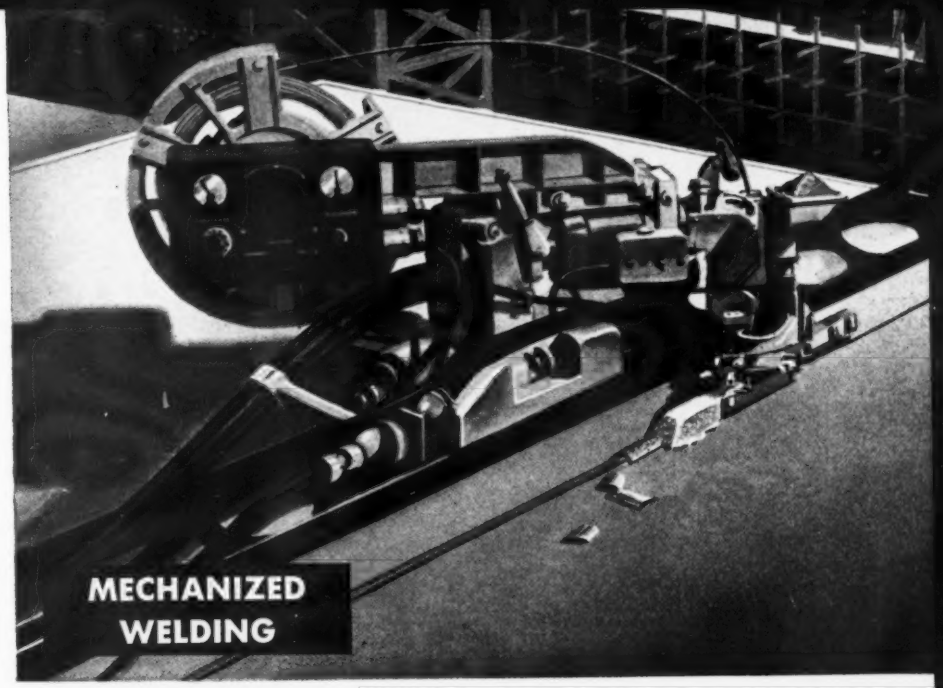
IN PREPARING FOR WELDING

Building a ship is essentially a job of steel "carpentry" . . . a job of cutting quantities of steel plate, structural members, pipe, and other steel shapes to fit . . . then joining them into one huge structure. In the job of *cutting*, oxy-acetylene equipment is effecting important savings, both in time and in materials. The oxy-acetylene cutting flame slices through steel in straight lines, circles, or irregular shapes. It does work that otherwise would require massive machines.

Linde engineering skill has helped adapt this "knife that never dulls" to high-speed work like the flame-planing shown here. In one operation, and with only fractional horsepower required, plate edges are trimmed to exact size and beveled like this for welding.

IN FABRICATING STEEL INTO SHIPS

The Victory Fleet of today is almost entirely welded — because welding is faster . . . saves as much as 20 per cent in steel . . . and because welded ships can carry more cargo, ton for ton. And on America's shipways today an amazing machine is being used to unite steel plates without noise, fuss, sparks, or visible arc . . . by Unionmelt electric welding. This process joins steel plates as much as 20 times faster than any other similarly applicable method! And it produces uniformly strong and ductile welds. The process is automatic. Together with the oxy-acetylene cutting flames that prepare plate edges for welding . . . it has helped to speed the fabrication of ships to its present remarkable rate.



THESE APPLICATIONS ARE IMPORTANT TOO

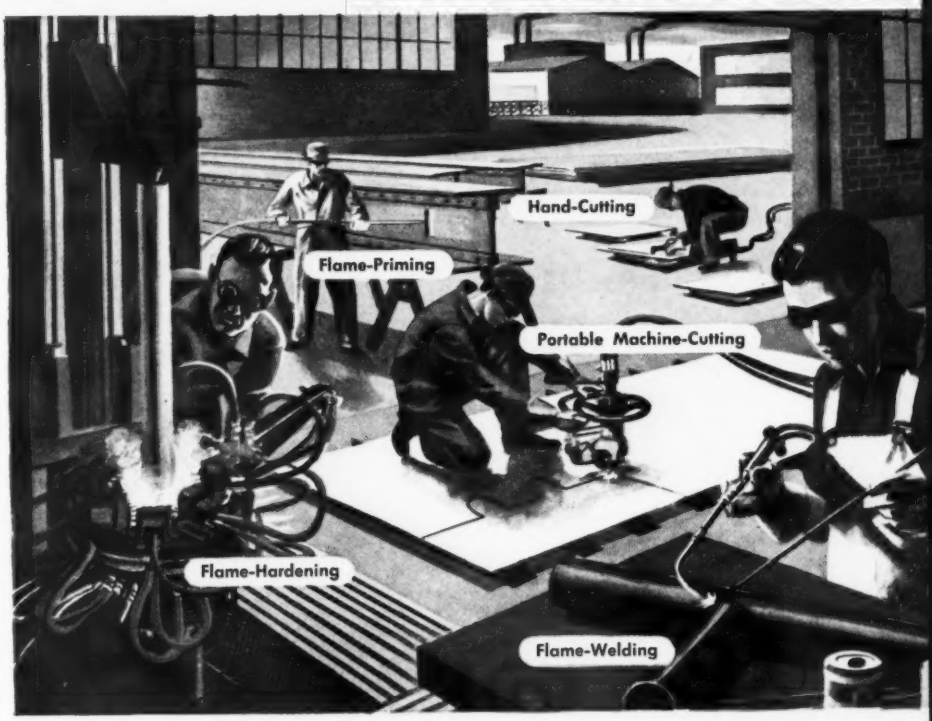
Hand-Cutting—The use of hand-cutting ranges from cutting scrap to severing the final bond to send the ship down the ways.

Portable Machine-Cutting — Lightweight flame-cutting machines produce steel shapes right on the job.

Flame-Hardening—Oxy-acetylene flame-hardening imparts a hard, wear-resistant case to steel and iron parts to make them last longer.

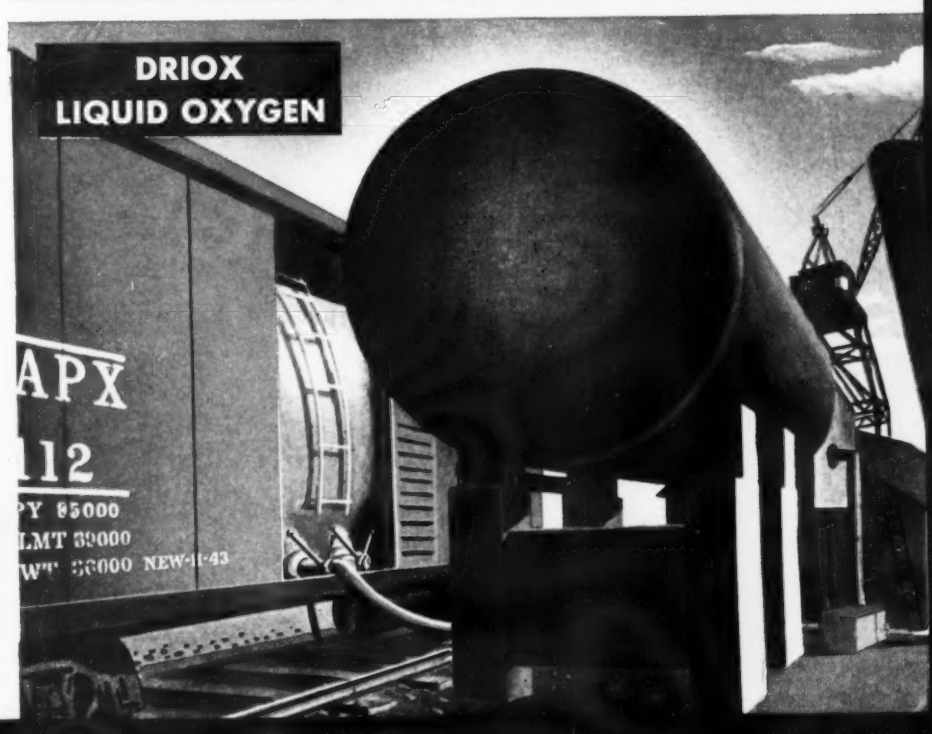
Flame-Welding — By oxy-acetylene welding, broken parts can be repaired . . . worn parts rebuilt . . . leakproof piping systems fabricated.

Flame-Priming—This process removes loose scale, rust, and moisture from steel structures prior to painting.



QUANTITY OXYGEN FOR QUANTITY USES

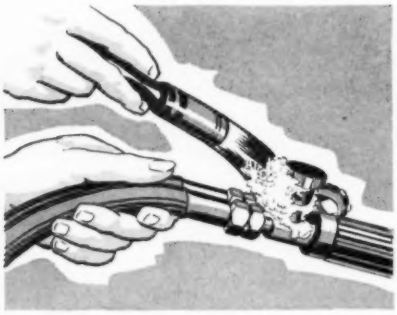
The demand of mass-production industries for oxygen is great. The development of Driox liquid oxygen has made it possible for these important industries to be supplied with oxygen shipped in bulk . . . as a liquid . . . in tank cars and tank trucks. As needed, the liquid oxygen is automatically processed to form gaseous oxygen at a predetermined pressure. This is distributed through pipe lines to operating stations where oxygen is used.



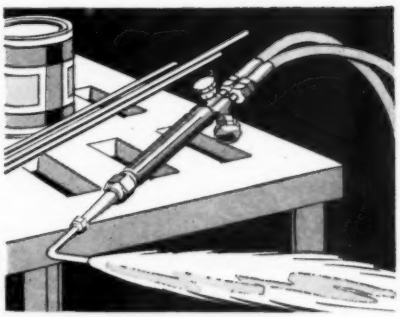
Please turn the page for conservation suggestions.

Here are suggestions to prevent waste of Oxygen and Acetylene in your plant

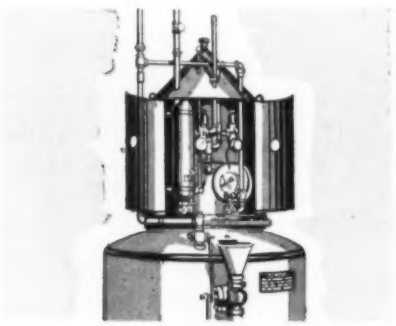
Centralize Oxy-Acetylene Work whenever possible. Concentrate welding, cutting, and other flame processes in as few departments as conditions permit. If this is done, cylinder turnover is speeded, handling is reduced, less apparatus and repair parts are needed, and waste of oxygen is more readily checked.



Check for Leaks. Make sure by frequent testing and prompt repair that no oxygen or acetylene is being lost through leaks in pipe lines, hose, connections, and other apparatus. An authorized inspector should conduct scheduled check-ups and keep track of the operation of each piece of apparatus on an inspection chart.

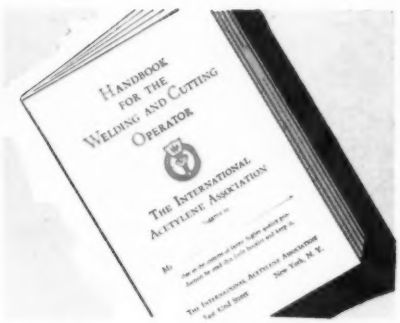


Eliminate Wasteful Practices. See that blowpipes are turned off when they are not in use. Use recommended pressures and nozzle sizes—not higher pressures or larger nozzles than are necessary. Be sure that cylinder valves are turned off immediately when operators have finished a job.



Convert to Generators. Consult your Linde service engineer to see if you should convert to an acetylene generator instead of using cylinders. A good generator, operated according to the manufacturer's instructions, should function efficiently indefinitely, saving you money and assuring your gas supply.

Recondition Damaged Equipment. Keep blowpipes, nozzles, regulators, and other apparatus in good repair. Some plants have floor inspectors that check equipment while in use and replace damaged apparatus on the spot. Apparatus in good condition helps to conserve gas and to get better results.



Use This Handbook. Give every operator a copy of the "Handbook for the Welding and Cutting Operator." It tells the do's and don't's of apparatus maintenance and provides tables of operating data for the operator to fill in on each piece of apparatus he uses. Send for as many booklets as you need.

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Unit of Union Carbide and Carbon Corporation

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SAVES TIME
FOR THE PIPING DESIGNER

Revised and Enlarged Edition

Simple and Easy to Use

Simplified Method for

CALCULATION OF PIPE WALL THICKNESS

for Various Pressures and Temperatures based on A.S.T.M. and A.P.I. Specifications and the A.S.A. Code for Pressure Piping

BULLETIN 43-A
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Originated and Developed by Engineering Department

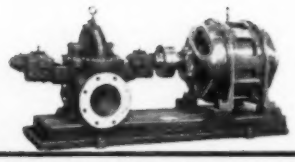
MIDWEST PIPING & SUPPLY CO., INC.
St. Louis 4, Mo., U.S.A.

This bulletin will enable you to determine quickly and easily the required pipe wall thicknesses for commercial pressure and temperature conditions. All you do is select a factor from a table, divide it into the working pressure and then refer the quotient to a chart. You have no substitution in formulae . . . no extensive calculations . . . no reference to codes or specifications.

This bulletin will gladly be sent to anyone interested who requests it upon a business letterhead. Simply mention Bulletin 43-A and address the main office at St. Louis, Missouri.

MIDWEST PIPING & SUPPLY CO., INC.
Main Office: 1450 South Second St., St. Louis 4, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles
Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • Tulsa—533 Mayo Bldg.

PIPING FABRICATORS AND MANUFACTURERS OF PIPE WELDING FITTINGS



Fighters on the WARREN PUMP Production Front. No. 6 of a Series

MAESTRO OF THE PLANER . . .

MASTER OF MANY JOBS . . .

CHARLIE GARDNER

Charlie Gardner is a Warren Pump Company planer operator, *par excellence*. He *has* been one for many years. But Charlie is also handy at operating other machines, such as large horizontal and large vertical boring mills . . . and has had many years of machine shop experience, as well. The reputation that Warren Pumps have *always* enjoyed for efficiency, reliability, and economy would not have been possible without the skill, experience and "pride of workmanship" that Charlie Gardner and other Warren employees have always possessed to such a high degree. And those Warren employees who are not in the armed services now, are giving *all* their energies and skill to make the Warren Pumps that will fight *for them on every front*, to help bring Victory.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

Conrad N. Lauer, 73, board chairman of the Philadelphia Gas Works Co, died August 2.

He started his business career with the Link Belt Co in 1893 and stayed with the firm until 1902. After 15 years as an industrial engineer he became associated with the Philadelphia Gas Works Co as secretary. He later became general manager, rose to president in 1929 and resigned that post about a year ago because of ill health.

Mr Lauer was a director of the Baldwin Locomotive Works, Bates, Inc, Baldwin-Southwark Corp, Cold Spring Bleachery, Cramps Brass & Iron Foundry, Federal Steel Casting Co, United Gas Improvement Co, the Midvale Co, and others.

o o o

E W Scarritt has been appointed sales manager of the **Elgin Softener Corp,** Elgin, Ill. A vice-president of the corporation, he has been associated with it since 1927.

A new pocket-size book, **"Maintenance and Installation Data,"** on **industrial fans and air-conditioning equipment,** is now being issued by the Buffalo Forge Co, Buffalo, N. Y. The book covers comprehensively all important steps in the installation and maintenance of fans and conditioning equipment. The book is available free of charge. Write **Buffalo Forge Co,** 468 Broadway, Buffalo, 4, N. Y.

General Electric Co is presenting a simple introduction to the electron and the principles that govern its use. "Primer of Electronics" (GED-1068) will be furnished free on request through the General Electric Electronics Dept, Advertising Division, Schenectady, N. Y.

John A Darling, for many years chief of electrical operations in the electrical section of the production department, **Boston Edison Co,** has been appointed assistant superintendent of that department.

With **George C Eaton,** whose appointment as assistant superintendent of the department took place some time ago, he will report to **H W H Wellington,** superintendent. **Henry L R Kurth,** assistant chief of electrical operations in Boston Edison's production department, has been appointed chief in place of John A Darling. **Andrew E Grant,** who has been with the company for about 36 years, has been appointed

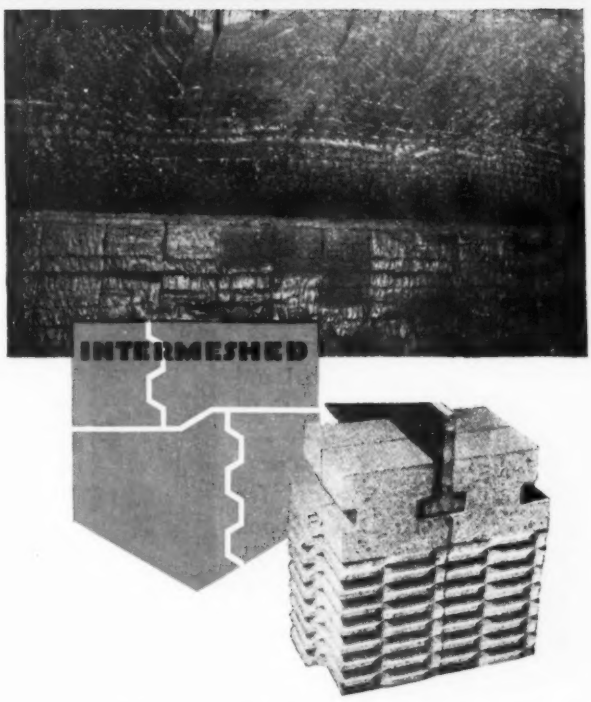
On Present Boilers . . . or New

Many war plants have found that a Detrick engineered furnace enclosure will permit them to work their existing equipment at higher capacity and yet have less outage for wall and arch repairs.

Long life under severe service is an old story among Detrick users. The photograph at the right demonstrates how a Detrick Arch can "stand the gaff" even under heavy loads. It is the soundness of Detrick engineering that makes this possible . . . engineering involving many principles learned the hard way through actual practice . . . thirty years of concentration on the one problem of enclosing heat.

One of these principles is the Detrick Tile design. All tile are faced with treads and intermeshed. Even though the corner of an individual tile may crack off the treads hold it in position and maintain the full thickness of refractory over longer periods.

If yours is the problem of getting more out of present equipment, talk it over with the Detrick man. If it's enclosing heat, he can help you.



Detrick Suspended Arches and Walls as applied on many different types of boilers and furnaces are described in the new 80-page catalog just off the press. It is practically a textbook on the subject of enclosing heat, presented in a way every engineer will like. Your copy is available on request.

M. H. DETRICK COMPANY
140 SOUTH DEARBORN STREET, CHICAGO

DETRICK FURNACE ENCLOSURES

Quoting SECRETARY ICKES:

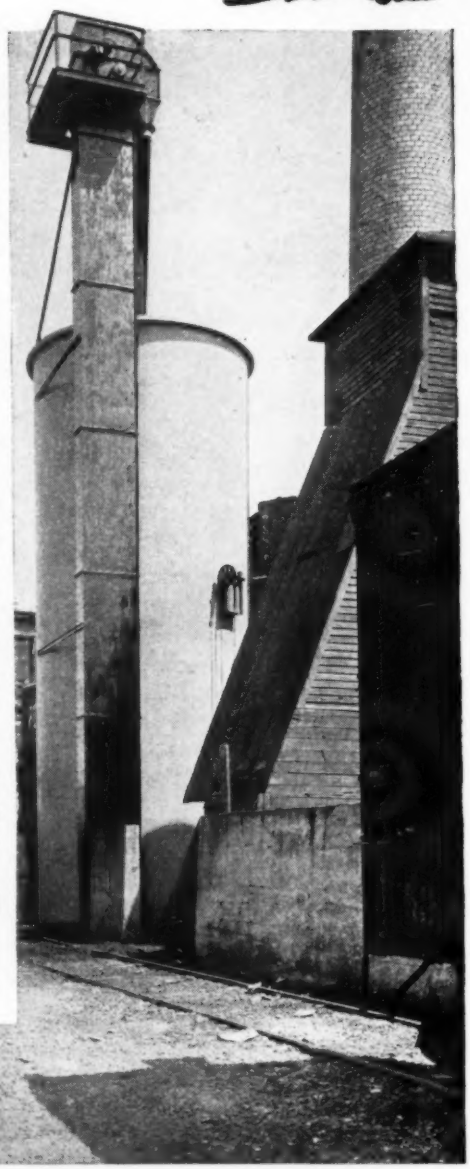
"A high percentage of industrial plants now converted to coal will not *re-convert to oil"**

There's more to conversion than simply getting equipment. It's important to have the installation engineered to insure efficient, economical, dependable operation, and that's where Gifford-Wood shines. Equally important are G-W facilities for doing the conversion job not only well, but quickly.

With many standardized designs needing but adaptation to meet conditions, with shop facilities for promptly producing the equipment, and unmatched experience in the design, production and installation of coal and ash handling systems, G-W is ready to serve you.

As a first step, write for Catalog 200-P, a source book of useful ideas—mostly illustrations, diagrams, mechanical drawings and tables.

* From "Coal's New Horizons," Coal Age, April 1943.



GIFFORD-WOOD CO.

FOUNDED 1814

420 Lexington Avenue, New York — **HUDSON, N. Y.** — 565 W. Washington Street, Chicago

Ash Spouts • Barge Unloading • Bins • Boiler House Equipment • Buckets • Bunkers • Carriers • Chutes
Conveyors • Crushers • Elevators • Feeders • Gates • Ground Storage Systems • Hoists • Hoppers
Infra-Red Drying Systems • Screens • Silo Storage Plants • Tanks • Weigh Larries

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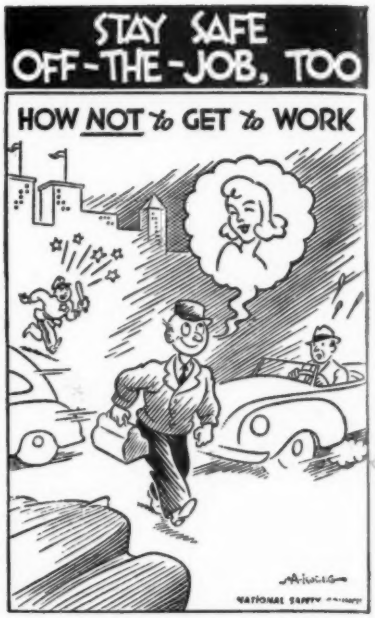


assistant chief of electrical operations, and **Arthur W Ferguson,** formerly of the industrial relations department, has been named production training engineer.

The Farris Engineering Co has established a new division to handle **valve repairs.** This division of the company is manned by skilled mechanics engaged in the actual manufacturing of valves, and is fully equipped to recondition and reconstruct all types of reducing, relief and standard or special valves and control apparatus. **Inquiries should be addressed** to the company at Ridgefield, N. J.

William L McGrath is a recent addition to the engineering staff of the **Carrier Corp.** Since his graduation from the University of Minnesota Mr McGrath has had extensive training and experience with the Minneapolis-Honeywell Regulator Co. . . . **C A Schroeder,** formerly manager of the Wisconsin-Minnesota district of **Globe Steel Tube Co,** has been made manager at Cleveland, Ohio. **E Gammeter,** formerly with the Carnegie-Illinois Steel Co at Chicago, has been appointed chief metallurgist.

An immediate start on development of a synthetic gasoline industry, through construction by the government of a plant for the manufacture of gasoline and other petroleum products from coal was urged on Congress recently by government officials, backed by scientists, economists and industrial representatives. Appearing before the Senate and House Public Lands Committee

In industry after industry

Pomona Pumps are setting new performance standards!

Take this STEAM PLANT for example

In the great new Harbor Steam Plant built by the City of Los Angeles, vast quantities of ocean water are needed for condenser cooling. The ocean water flows in to the 80 ft. long chamber shown at right from where it is pumped through the plant by Pomona Vertical Pumps, one of which you see projecting down into the reservoir. Initially, only two 24,000 g.p.m. pumps are installed, but eventually ten of these pumps will be used. This entailed a difficult engineering problem, for as new pumps are added changes in flow, friction losses, etc., cause a considerable change in the static head.

It was found that with all pumps—*except Pomonas*—a costly change in pump bowls or motor speed would be necessary when all ten pumps are installed. *With Pomonas, only an inexpensive impeller change is required.*

In addition, because Pomonas are vertical pumps, they can be installed directly *over* the reservoir without need for costly dry pits and the resulting installation and maintenance problems. Extra valves and fittings are also eliminated and the vertical construction provides the flexibility necessary for ready conversion to changes in head conditions.

As a result, the Pomonas make important savings in installation costs—in operating costs—and in change-over costs . . . *a three-way saving!*

POMONA Vertical Turbine Pumps embody so *many* advanced features—features that save power, minimize maintenance, conserve space, and increase over-all operating efficiencies—that they are literally revolutionizing pump performance standards in industry after industry. They are staying on the job *longer* with less upkeep. They are delivering *more* water against *higher* heads at greatly reduced power costs. They are cutting floor space requirements as much as 60% over that required for other-type pumps. *And they are making many other vital savings!*

These are *facts* backed by user-reports from thousands of Pomona installations in widely-varying industries . . . facts you should investigate before *your* next pump purchase. Pomona engineers will gladly supply complete details on the savings you can expect from a Pomona installation on *your particular* pumping job.

CUT POWER COSTS

Pomona's semi-open impellers, easily adjustable at motor, vary the capacity of the pump according to requirement . . . and with proportionate savings in power. Eliminates wasteful throttling!

SAVE SPACE

Pomona's modern vertical design puts the pump at fluid level where it needs no priming . . . the motor at floor level where it occupies minimum space. Eliminates complicated priming equipment!

DELIVER MORE FLUID

90%—and higher—pump efficiencies are not uncommon due to Pomona's Bulbous Vane End shape which smooths fluid flow—minimizes friction—increases efficiency!

TROUBLE-FREE OPERATION

Because *all* bearings below the motor head are fully lubricated by the fluid being pumped there is no risk of contaminating product or equipment with oil film. No oil or grease tubes to maintain.

JOSHUA HENDY IRON WORKS

Pomona Pump Co. Division • 50 Church Street, New York 7, N. Y.

Plants: 4301 S. Spring Ave., St. Louis, 16, Mo.; 206 Commercial St., Pomona, Calif.

POMONA
Water-Lubricated
PUMPS

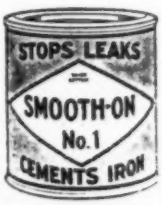
SMOOTH-ON
REPAIR
RECORDS
Repair of Steam Chest
The SMOOTH-ON repair of this long crack was reinforced by a patch plate and supporting straps or bands. The plate is held in place by machine screws, and the repair, strengthened in this manner, has been thoroughly successful in many similar instances where the apparatus is under pressure.
Smooth-On
FOLLOW THIS SERIES OF SMOOTH-ON SAVINGS

This repair is typical of many instances in which the life of important and expensive apparatus has been saved and extended for many years by means of SMOOTH-ON No. 1. Note that no heat nor dismantling of apparatus was necessary, nor were any special tools required. Cylinder heads, pump casings, shells of evaporators, heaters and process apparatus, engine water jackets, and similar equipment may be lastingly repaired in the same manner.

And SMOOTH-ON has other helpful uses, too, for this many-purpose iron repair cement stops leaks in piping, joints, seams, etc., and tightens loose parts of apparatus, fixtures, tool handles, etc.

Be sure to buy a can of SMOOTH-ON without delay, so you will be prepared to make necessary war-time repairs speedily and effectively.

Buy SMOOTH-ON in 7-oz., 1-lb., or larger containers from your supply house, or if necessary, from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men for over 45 years.



FREE

REPAIR HANDBOOK SHOWS HOW

40 Pages, 170 diagrams, and simple concise instructions for practical repairs to plant equipment, pipe lines and structures. A necessity in every plant. Your copy sent FREE if you fill in and return the coupon.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City 4, N. J.
Please send SMOOTH-ON HANDBOOK

Name .....

Address .....

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9-43

Do it with SMOOTH-ON
The Iron Repair Cement of 1000 Uses

the witnesses exhibited synthetic gasoline made in Pittsburgh at the United States Bureau of Mines Experiment Station where a synthetic plant has been in operation for eight years. The gasoline has been used in airplanes and tanks, and the committee was shown a motor operating on the fuel. The Pittsburgh plant is the only one in the Western Hemisphere producing synthetic gasoline. Using a hundred pounds of coal a day, it turns out liquid fuel by the Bergius process, at a cost of 12 to 25 cents a gallon.

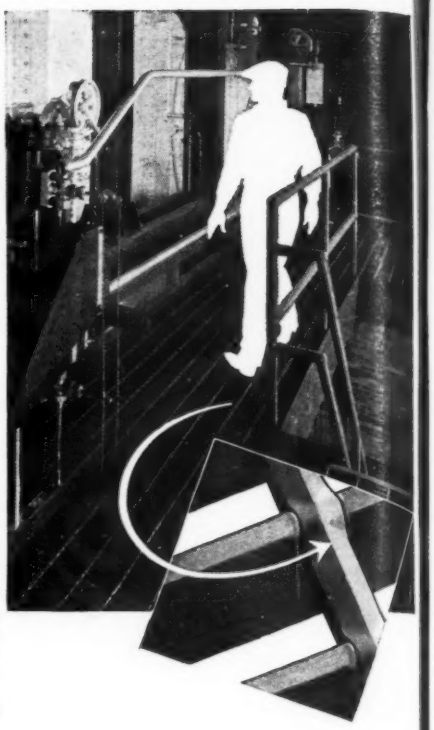
Julian E Tobey has been reappointed chairman of the Technical Advisory Board of **Bituminous Coal Research, Inc.**

The Hydraulic Institute, the national trade association of pump manufacturers, announces complete revision of the Test Code Section of its Standards. This Test Code Section, first published in 1936, contains **specific recommendations for the testing of centrifugal and rotary pumps,** both for acceptance tests in the field, and in the plant of the pump manufacturer. Copies of the revised section may be secured from the Hydraulic Institute, 90 West St., New York, 6, N. Y.

Worthington Pump and Machinery Corp, Harrison, N. J., announces the acquisition of **Ransome Machinery Co,** of Dunellen, N. J., as a wholly-owned subsidiary of Worthington.

Edgar C Brandt has been elected a member of the board and vice-president in charge of manufacturing of the **Elliott Co,** Jeannette, Pa. Mr Brandt comes to the Elliott Co after 38 years with the Westinghouse Electric & Mfg. Co. . . . **Buford M Stubblefield** has been appointed superintendent of the Brier Hill Works of the **Youngstown Sheet & Tube Co,** succeeding A S Glossbrenner who is now general superintendent of the Youngstown district plants. Mr Stubblefield started to work for the Youngstown Sheet & Tube Co at the Campbell Works plant in 1916.

J W Peckham is now manager of the development and design engineering department for The Bristol Co, Waterbury, Conn. Mr Peckham joined the radio research department of the General Electric Co in 1921, and in 1922 joined the Bristol radio engineering department. . . . **Marcello A King** has joined the **Worthington Pump & Machinery Corp** as executive engineer



THERE **IS WHY IT IS GOOD BUSINESS TO SEE THAT YOU GET**

BATES-GRATES

FOR OPEN STEEL FLOORING

That scraper edge on the Bates open steel flooring cross bar is cleaner and safer. You grasp the idea from even a quick glance at the picture. Yet it doesn't cost you a cent more.

You get those extra advantages because the Bates patented process builds a fillet from displaced metal—in addition to the clean scraper tread of the "Hex" cross bar, giving you smoother, cleaner, larger welds *and stronger flooring.*

The whole process is explained—and many fine installations pictured—in the 8½ x 11 catalog, "FILLET-WELD BATES GRATES." Write for a copy.

WALTER BATES COMPANY, INC.
JOLIET, ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

BEHIND THE GUNS!

SHAW PREFABRICATED PIPING

Since Pearl Harbor, here at Shaw we have been meeting the war's fantastic needs for "more" — these constant and increasing demands have helped us to develop the "know-how" which will be invaluable in helping to solve post-war production problems.

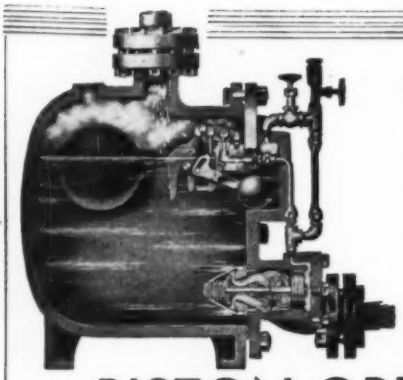
Today, we are concentrating our effort 100% in producing piping to be used in processing Explosives, 100 Octane Aviation Gasoline and Synthetic Rubber; piping for Lend Lease Power Plants and Destroyer Escort Vessels. We are working on the production front — "behind the guns."

PRESIDENT

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets
Wilmington, Delaware

50th Anniversary Year



Power Engineers

Can Be Absolutely Sure of Dependable Efficiency and Economical Durability by Specifying

NICHOLSON PISTON-OPERATED TRAPS

for Super Pressures and Super Heat

Write for Catalog No. 941

See our Catalog in Sweet's

A positive, instantaneous, high pressure trap which occupies smaller space yet has greater capacity than any others available. The discharge valve is non-wire-drawing type, being entirely open or closed at all times—orifices of these traps range from 1" to 4" for all pressures up to 650 lbs., as compared with ⅛" to ½" used on the average trap. All valves, seats and working parts are of stainless steel for long trouble-free operation . . . for Super-Pressures and Super-Heat in the Super-Power Plant.

W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA.

NICHOLSON *Traps*

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

Cutout shows locking ring. Pat'd. & Pats. Pending

By the UNSHAKO Self-Locking Nut

Reg. U. S. Pat. Off.

. . . and the "Unshako" plays no favorites. Wherever applied, it clamps down with a relentless grip and positively prevents loosening under vibration. The built-in self energizing locking ring never relaxes it hold . . . yet the "Unshako" *can* be readily backed off with a wrench and used over and over again as often as desired. Write today for full details.

OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

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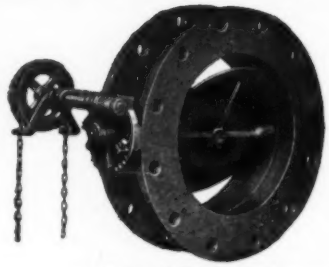
ROCKWELL BLAST GATES



Flanged Butterfly Type with Chain Wheel Control

Eliminate Air Leaks

Leaks can't occur at the blades, because of their tight closure . . . nor at the stuffing boxes, because of the deep, well-packed glands . . . nor at the pipe connection, because of the accurate machine work at threads or flanges.

Rockwell Blast Gates assure perfect control of low-pressure air . . . after long service as well as when new. Write for Bulletin 4020 describing their many advantages in detail.

W. S. ROCKWELL COMPANY

Blast Gate Division

50 CHURCH STREET NEW YORK 7, N. Y.

of the Moore Steam Turbine Division, Wellsville, N. Y. Engaged in turbine engineering and manufacture since his graduation from the university of Michigan in 1916, he was with the Kerr Turbine Co and later with the Elliott Co, where he held the position of manager of engineering.

Frederic I Lackens, advertising manager of the **Hays Corp,** has been elected president of the **National Industrial Advertisers Association.** Mr Lackens is widely known in advertising and industrial circles, having been connected intimately with both since before the first World War. His new duties as president of the NIAA will not interfere with his connection at the Hays Corp.

Dewey C Harvey has been appointed chief plant engineer of the Osborn Mfg Co, Cleveland, Ohio. Prior to joining the company in 1935 Harvey served in the engineering departments of the Peerless Motor Co, C O Bartlett & Snow Co, and the Bender Body Co. . . . **A T Huizinga** has resigned as assistant

CURRENT ARMY-NAVY AWARDS

Babcock & Wilcox Co, Augusta Works. White-Star award presented recently.

Bonney Forge & Tool Works. White-Star award presented recently.

Dow Chemical Co, Western Division. Award presented July 28.

Skilsaw, Inc. Award presented June 7.

Wallace & Kiernan Co, Inc, and **Wallace & Kiernan Products, Inc.** White-Star award presented recently.

The Air Preheater Corp. *Maritime "M" Award presented July 19.*

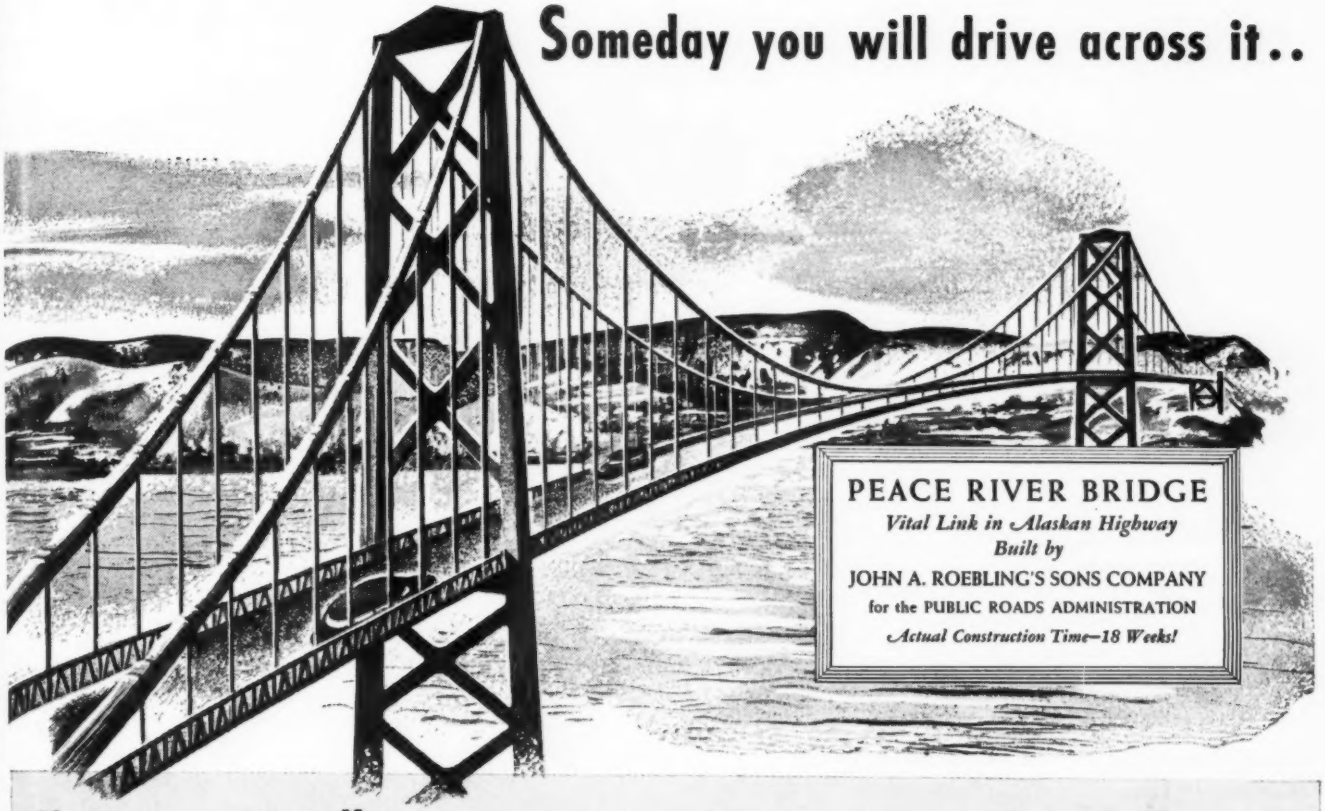
Westinghouse Electric & Mfg Co. Mansfield Works. Award presented recently.

A P Green Co. *Maritime Gold Star award presented June 25.*

Westinghouse Electric & Mfg Co. Meter Division. Award presented recently.

The Brown Instrument Co. Award presented recently.

Someday you will drive across it..


PEACE RIVER BRIDGE
Vital Link in Alaskan Highway
Built by
JOHN A. ROEBLING'S SONS COMPANY
for the PUBLIC ROADS ADMINISTRATION
Actual Construction Time—18 Weeks!

You're going to see the Yukon!

YOU BREAKFASTED in Dawson Creek, and now your car hums along the smooth Alaskan Highway, through the wide, pine-studded country of British Columbia. Around a curve, and suddenly, before you stretches the valley of the Peace River, spanned by one of man's most beautiful works . . . the suspension bridge. "Here's a bridge," you'll say to the family, "that helped to win the war."

You may stop a moment beside the bridge's approach, to tell them more about it. "That's a lot of river," you may say. "Two thousand feet wide, running 8 miles an hour! And here in the wilderness, a great bridge . . ."

"How ever did they get it here?" your wife asks, ever practical. "Well," you say, "it's 40 miles from rail, at Dawson Creek. They trucked it here,—100 freight car loads of material and equipment—not in balmy summer weather either. It was in the winter and spring of 1943. Bitter cold, snowing, blowing . . ." And before it reached Dawson Creek lay the urgent, anxious period of design, details, orders, priorities, manufacture and shipment, all compressed into the unbelievably short time of 18 weeks, an achievement made possible by the most complete co-operation between Roebling and the U. S. Public Roads Administration with the timely assistance of the U. S. Engineers when special priorities were required.

"There wasn't much here when the men arrived. Roebling carpenters built weather-tight shacks for the men. Roebling men cut wood for Roebling cooks who kept their stoves heated red. Disease struck, and at one time eighty men were down. From Trenton, medicine was packed, and flown by plane . . ."

"Was the river frozen?" Johnny queries.

"It was frozen fifty-four inches thick. 4½ feet of ice. So they used the ice—built their construction tower on it. Because it was the fastest way. But they gambled, for they knew the ice would thaw. The break-up would come in March. *Ice unsafe after March 15 and almost certain to be dangerous by April 1.* That was the report.

"They raised one bridge tower, then skidded their 100-ton construction tower across the ice to raise the other one. Just like a sled. They had to hurry. But they won.

"After the break-up, the bridge towers stood safely pointing to the sky. They needed motorboats, but there were none. They built them. The 'John A. Roebling' and the 'Washington Roebling,' named for America's bridge-building pioneers, helped the Army ferry as they worked to build the bridge. One operation followed another in rapid succession as Roebling, working hand in hand with P. R. A. field men maintained the tempo and rushed the bridge to completion."

"This bridge was so vital," you continue, "that as soon as the cables were spun across, they carried a gasoline pipe-line over on them. Trucks shuttled to one end of it, and from the other end toward the Alaska-based bombers and fighters,—and Tokyo . . ."

You swing your car onto the bridge and purr along, a hundred feet above the swift Peace River. "They finished it in record time. In August, 1943 . . ."

"Surpassing their 100 year record as bridge builders, Roebling has done a magnificent job at Peace River," says Commissioner Thomas H. McDonald of U. S. Public Roads Administration. "Construction is complete . . . 7½ months after the contract's signing . . . 18 weeks after the setting of the first piece of steel . . . cutting in half the best previous construction time!"

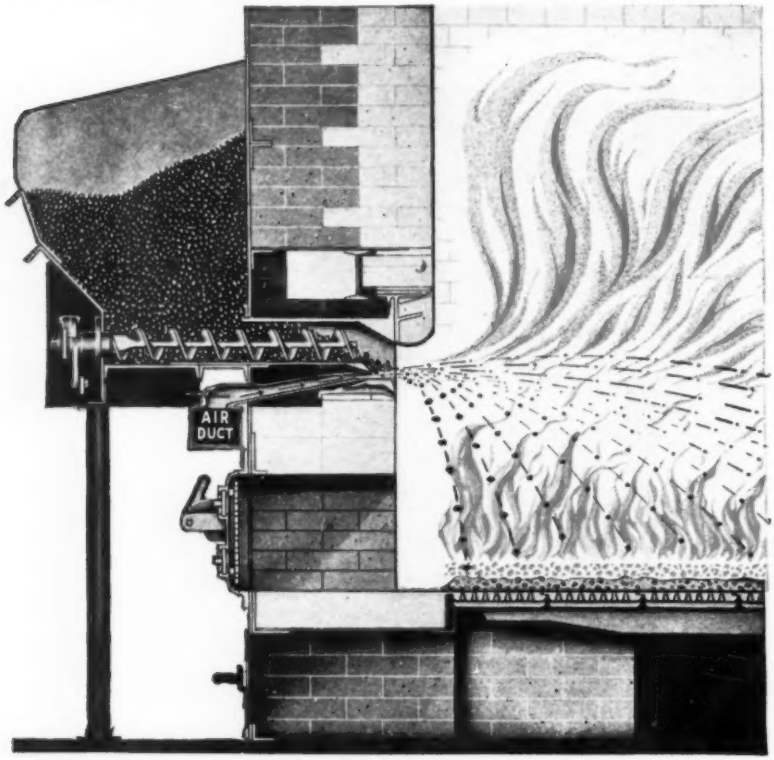
If you would like to read more of this Roebling saga, and own a color reproduction of the Peace River Bridge, write today. John A. Roebling's Sons Company, Trenton 2, New Jersey.

JAR ROEBLING

ROEBLING

Bridge Builder . . . Pacemaker in Wire Products

Need more steam *Capacity?*



USE FYR-FEEDER MULTIPLE-SPREADER STOKERS

Good news for plants with overloaded boilers: Priorities are being granted for FYR-FEEDER stokers to plants requiring additional steam generating capacity. **QUICK DELIVERY:** *We can make quick delivery on Fyr-Feeder stokers, which can be installed with a minimum loss of production time, and without major alteration to present boiler equipment.*

FYR-FEEDER STOKERS burn any kind and size of bituminous screenings or coal yard sweepings. FYR-FEEDER features: Suitable for large or small boilers . . . low maintenance . . . low power requirements . . . maximum active coal burning area (no dead plates) . . . easily accessible multiple feeding units . . . large coal hopper capacity . . . accurate over-fire air control . . . no clinkers . . . can be operated by anybody.

WRITE FOR CATALOG *and have an engineer make a survey of your plant, without obligation, to show you what FYR-FEEDER can do.*

AMERICAN COAL BURNER COMPANY
ENGINEERS • ESTABLISHED 1918
Builders of thousands of Industrial Stokers

32-18 E. Erie St. **Chicago, Illinois**

treasurer of Montgomery Ward & Co to become treasurer of the **National Supply Co** at Pittsburgh, Pa. . . . **W F Dashiell,** who has been a member of the **Boston Woven Hose & Rubber Co** sales organization, has become Southern district sales manager.

W W Forman has been appointed assistant general superintendent of the Connecticut Light & Power Co with headquarters at Waterbury. He is well known in the steam plant field, having been engineer in charge of the installation of the lately completed 45,000-kw addition at the Devon station and the 25,000-kw extension at Montville. . . . **Harold D Kelsey** has been appointed assistant to the manager in charge of engineering at the Fort Wayne Works of the **General Electric Co.** He succeeds the late R H Chadwick. Mr Kelsey entered the employ of the company in 1920, after being graduated from Syracuse University.

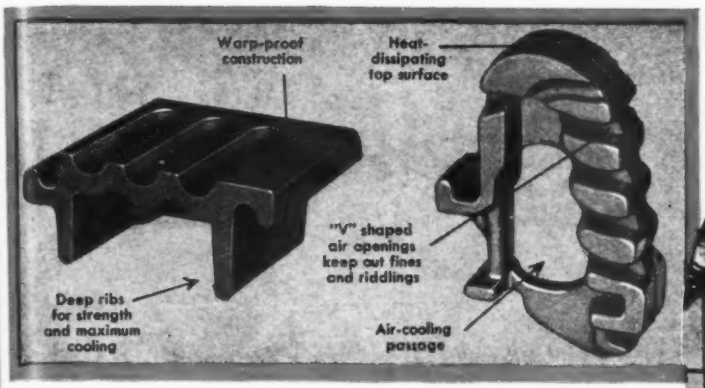
W F Armstrong has been named special assistant to Albert Bradley, executive vice-president, **General Motors Corp.** Mr. Armstrong returns to the corporation after an absence of six years, during which time he served as vice-president with the Nash Kelvinator Corp. Previous to that time he had been employed by General Motors Corp or its subsidiaries since 1912. . . . **Matthew R Rosse** has been appointed sales manager of the export division of **Wickwire Spencer Steel Co.**

Joseph H Yarnall has been appointed superintendent of power for the Boston, Mass., Elevated Railway, succeeding the late Frederiok S Freeman. Mr Yarnall entered the Boston company's employ in 1906, was made assistant engineer in 1909, and in 1923 was appointed power engineer. He became assistant superintendent of power last March. . . . **Ralph J Cordiner** has been appointed assistant to the president of the General Electric Co. Mr Cordiner, who resigned in June as vice-chairman of the War Production Board, was formerly president of Schick, Inc, of Stamford, Conn.

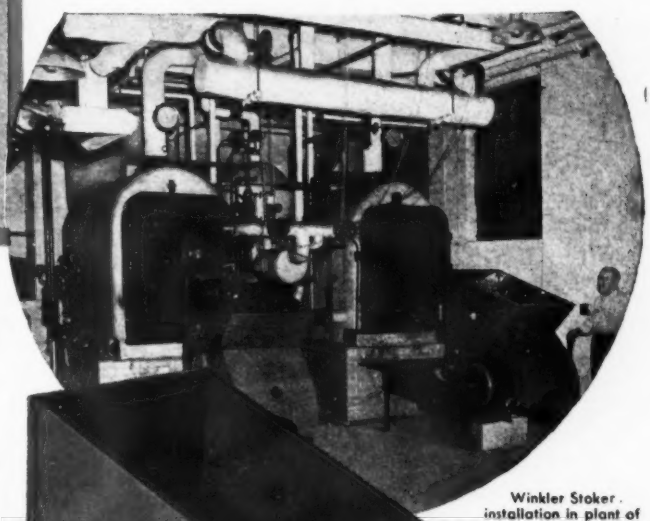
C Robert Powers has joined the manufacturing division of **Carrier Corp,** Syracuse, N. Y., in the capacity of production control manager. Mr Powers will have full responsibility for the preparation and control of all manufacturing schedules, delivery promises and flow of material. . . . **Fred E Harrell,** assistant chief engineer of the Reliance Electric & Engineering Co

A WINKLER IS STRONGEST

WHERE THE GOING IS TOUGHEST!


Warp-proof construction
Heat-dissipating top surface
"V" shaped air openings keep out fines and riddlings
Deep ribs for strength and maximum cooling
Air-cooling passage

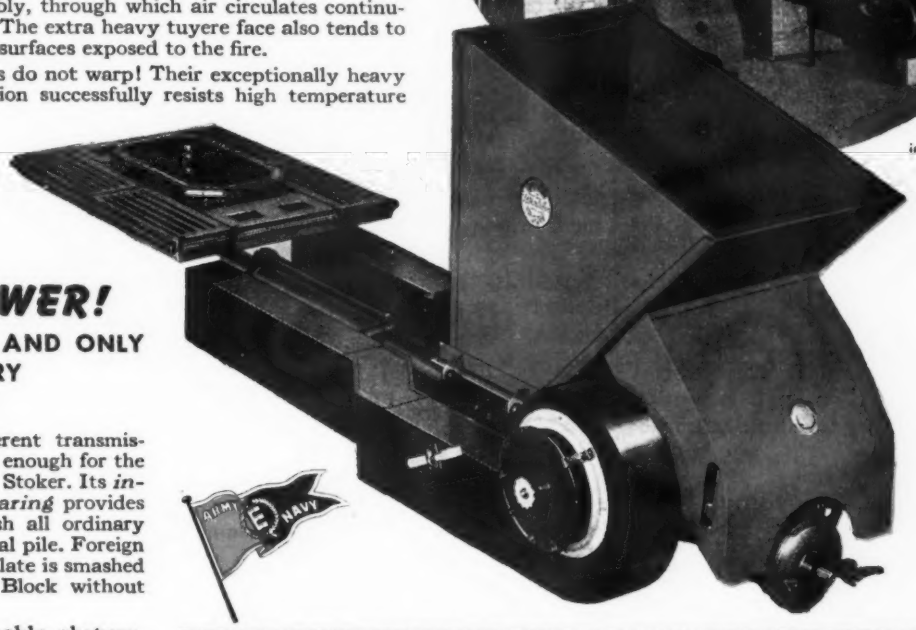
At the points where operating wear and tear is most severe, the Winkler Stoker demonstrates and proves its superior engineering



Winkler Stoker installation in plant of nationally famous manufacturer

Temperatures up to 3000° around the tuyeres and dead plates of a stoker demand constructions which can withstand and properly dissipate terrific heat. To meet this need, Winkler Tuyeres are literally *air conditioned!* A large ventilating passage is built into the tuyere assembly, through which air circulates continuously to remove heat. The extra heavy tuyere face also tends to carry away heat from surfaces exposed to the fire.

Winkler Dead Plates do not warp! Their exceptionally heavy cross-ribbed construction successfully resists high temperature distortion.



EXTRA POWER!

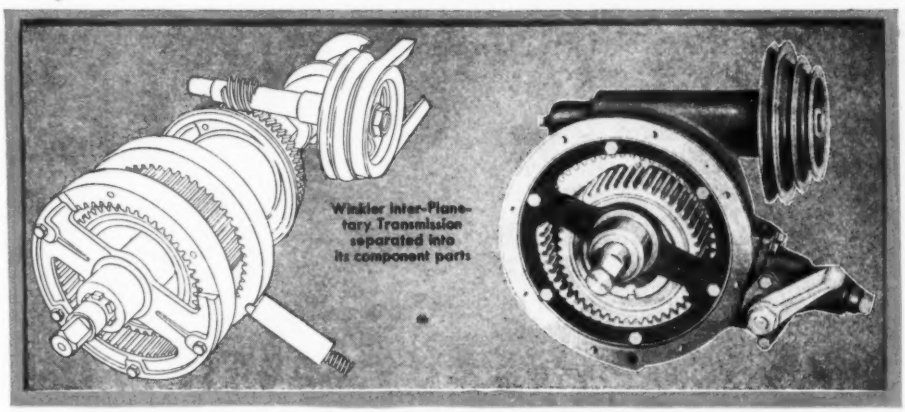
FROM THE ONE AND ONLY INTER-PLANETARY TRANSMISSION

This completely different transmission is in itself reason enough for the selection of a Winkler Stoker. Its *internal planetary gearing* provides *extra power* to crush all ordinary obstructions in the coal pile. Foreign material like rock or slate is smashed against the Crusher Block without service interruption.

Metallic, uncrushable obstructions are handled by the Winkler Safety Release. In the case of a locked screw, the Safety Release *automatically* disengages and resets the transmission until the obstruction is removed. Positive protection is thus given to the motor and operating parts, without need for a shear pin or electrical overload switch.

It is the only *fully automatic transmission*—and guaranteed for three years.

FOR FULL INFORMATION CALL YOUR LOCAL WINKLER DEALER OR WRITE TO THE FACTORY



WINKLER

fully automatic **STOKERS**

U. S. MACHINE CORPORATION
LEBANON, INDIANA

Your Blueprint for
MORE POWER
starts with
OAKITE CLEANING

. . . Improving Heat Transfer of Your Feed Water Heaters

Unless lime-scale and other deposits that accumulate in feed water heaters are removed, heat transfer is reduced and operating efficiency impaired. When this occurs, the best thing to do is to get rid of these insulating accumulations QUICKLY.

Do this job easily, thoroughly by using OAKITE COMPOUND No. 32! Just circulate recommended solution for required period as directed by our nearby Technical Service Representative. You will find deposits are effectively, safely removed . . . normal operating efficiency restored!

WARTIME SERVICE FREE!

Helpful Oakite Wartime Service is yours FREE on this or such other jobs as cleaning and de-scaling surface condensers, Diesel engines, lube oil and jacket-water coolers, and water-cooled compressors. Write today!

OAKITE PRODUCTS, INC.
23 Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE Specialized cleaning
Buy Bonds for Victory
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

since 1934, has been appointed chief engineer of that company. For the past ten years Mr Harrell has been acting as executive director of a new marine division plant for Reliance.

Charles R Hook and **Elisha Walker** have been elected to the board of directors of the Westinghouse Electric & Mfg Co, it was announced recently. Mr. Hook is president of the American Rolling Mill Co and Mr Walker is a partner of Kuhn, Loeb & Co.

The Technical Association of the Pulp and Paper Industry will hold its next Wartime Service Conference at the Palmer House, Chicago, Ill., September 21-24, 1943.

United States Department of Labor has published "A Guide to the Prevention of Weight-Lifting Injuries," Special Bulletin No. 11. This booklet is mainly a result of the influx into war production of untrained workers, many of them women and older men which has led to an increase in danger from this type of injury. Copies can be obtained for ten cents by addressing the Superintendent of Documents, U S Government Printing Office, Washington, D. C.

The Air Express Division of the Railway Express Agency announces new booklet, **"How to Ship by Air Express During Wartime."** This is an indexed handbook in file form on the "Who—What—Where—When— and How" of air shipping.

Emsco Equipment Co, Newark N. J., announces the appointment of **Raymond D Seely** as the new sales manager of the machinery and equipment division. . . . In order to coordinate sales involving the apparatus of more than one division of its electrical department the **Allis-Chalmers Mfg Co** has appointed **L W Long** as sales engineer in charge of mixed apparatus sales. Mr Long joined Allis-Chalmers in 1925.

Fred L Hall has been appointed vice-president in charge of sales of the Rogers Diesel and Aircraft Corp, New York, N. Y. Mr Hall, who has been sales manager for the Bendix-Westinghouse Automotive Air Brake Co for the past six years, started his career with Westinghouse in 1927 as an apprentice in the Union Switch and Signal Co in Pittsburgh, Pa.

Dr Thomas E French has been named recipient of this year's Lamme Medal Award for meritorious achievement in engineering. Dr French is the author of **"A Manual of Engineering**

"Ring of Distinction"

Install FRANCE Metal Packing for "Round-the-Clock" PRODUCTION

The renewal of ordinary packing every few weeks or months increases horsepower and production costs. Minimum friction is encountered with France Metal "Ring of Distinction" Packing. No undue force can be exerted on rods or stems by tightening the stuffing box stud nuts. The rings are free to float in the case that retains them and are held to the rod or stem with a garter spring having minimum tension.
The result is tight "full-floating", trouble-free performance for years. Prompt delivery assured.

FREE

44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-7, with facts on

- Packing Designs for Any Service
- Installation Procedure
- Methods of Lubrication
- Pressures and Temperatures
- Oil Return and Stripping Rings
- Handy Reference Tables

Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY
Tacony, Philadelphia 35, Penna.

Original FRANCE METAL PACKING

Can we turn the Handle

ON YOUR FREEZER?

Ever stop to think what happened, to take ice cream out of the bulging bicep department?

Power took hold, and turned the handle.

Pop sat back and watched, smiling from ear to ear. Price came down, too. Mom was pleased. The kids? Well...

We don't think it's boasting when we remind you that Diesel Power is one of the best ways in the world to turn handles. The Army and Navy think so. They've got us so busy building Diesels that turn pumps, and generators for light and radio, and winches and all kinds of other things, that we couldn't turn a handle for you now, even though we want to. And we don't want to now, unless it's fastened onto something that's headed for Tokyo or Berlin.

But it makes our mouths water to think of all the handles that are going to need turning after the war. Dependably, cheaply, safely—as Diesel Power can turn them. On farm equipment . . . construction machines . . . industrial products, to name just a few . . .

If you'll tell us about how big your freezer will be, and how fast you want it turned, we can both be thinking about it. And *you* can lick the dasher. Rogers Diesel and Aircraft Corporation, 1120 Leggett Avenue, New York 59, N. Y. *Divisions:* Hill Diesel Engine Company, Edwards Company, Edwards Aircraft Products, Inc., Ideal Power Lawn Mower Company.

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DIESEL AND AIRCRAFT CORPORATION

Diesel Engines, 5 to 2000 h. p. » Gasoline Engines » Generator Sets
Generators » Power Units » Switchboards » Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms
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The ADVANCED STEAM TRAP with NO MOVING PARTS

WIDELY ACCEPTED

because of these distinctive features:

EXTREME SIMPLICITY — No moving parts. No annual repair bills. Lowest possible maintenance. Marked saving of valuable man hours.

CONTINUOUS and COMPLETE DISCHARGE of condensate, air and non-condensible gases. Maximum efficiency in heat transfer assured.

OPERATES EFFICIENTLY under a wide variation in steam pressure and volume of condensate and air.

GIVES VISIBLE INDICATION that complete drainage is taking place. No checking necessary.

NO BY-PASS NEEDED. Fits into the line like a valve. Saves installation labor and fittings.

Get THE COMPLETE Story in Bulletin No. 903A

The COE MFG. Company
501 BANK STREET • PAINESVILLE, OHIO

Drawing," said to be the most widely used engineering text in the world, having gone through six editions. The award to Dr French, Emeritus professor of Engineering Drawing, has been approved by the University's Board of Trustees, on recommendation of the Faculty Lamme Medal Award Committee.

Conservation in the use of steel in the manufacture of heavy duty steam boilers was ordered July 1 by the War Production Board.

Order L-299 provides that power boilers, except those for locomotive or marine service, may not have a greater metal thickness or quantity of steel than needed to meet the minimum thickness requirements of the American Society of Mechanical Engineers Boiler Construction Code. Boilers affected are those for a design pressure exceeding 15 pounds per square inch.

The restrictions do not apply to boilers in process on July 1 or those into which a tube is rolled.

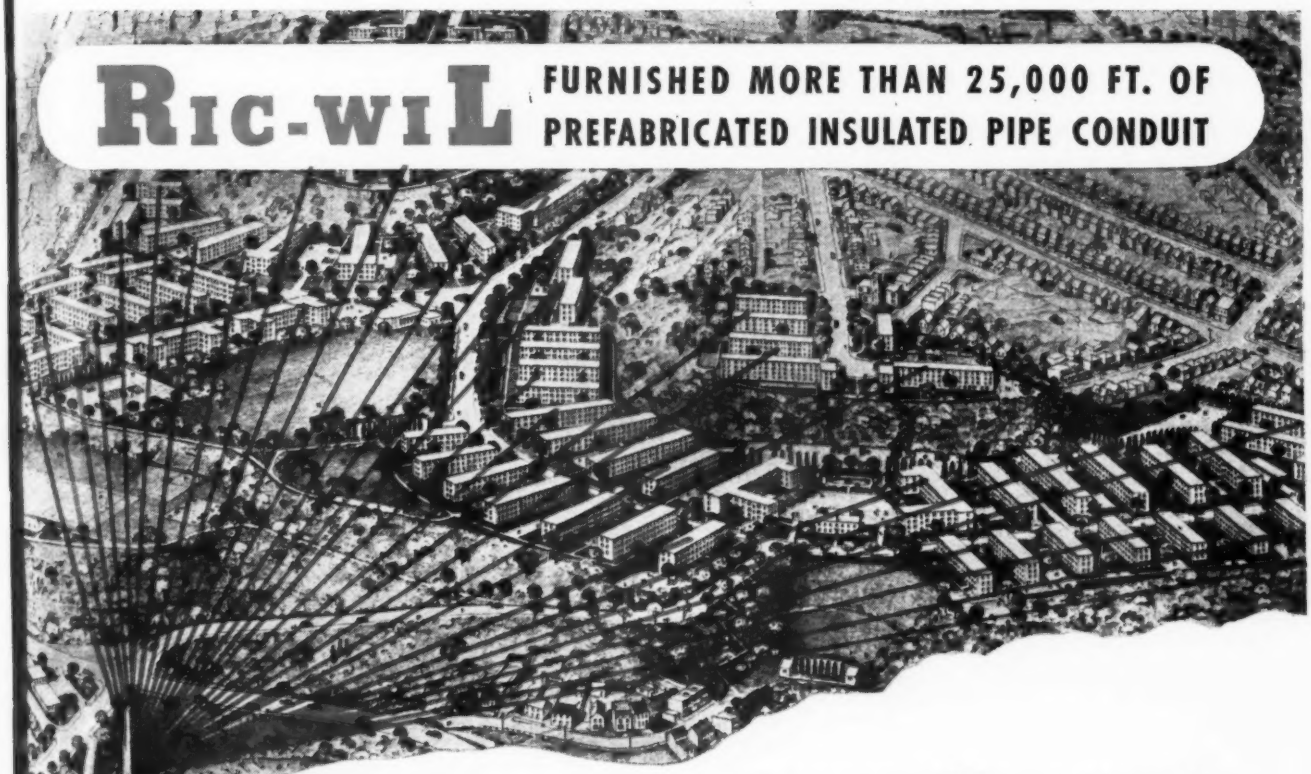
Limitation Order L-299, Effective July 1, 1943.

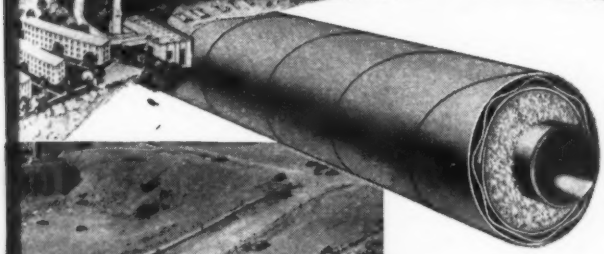
James S Thompson, executive vice president of the **McGraw-Hill Book Co,** accompanied by four other well-known book publishers, recently completed a tour of Latin-American countries. The six-week trip was made by airplane. **Semi-official in character,** the tour was aimed to increase the exchange of books and other publications between the two Americas. In addition to his status in the publishers' group, Mr Thompson represented the **Society for the Promotion of Engineering Education,** of which he is treasurer.

Roland R Ware, for the past thirteen years general manager of the **Clarage Fan Co,** was elected president May 7. Mr. Ware succeeds Harry Clarage, who was named chairman of the board of directors. Other officers elected were **S A Schaeffer,** vice-president; **C A Kline,** secretary, and **C C Wheeler,** treasurer. . . . **Sullivan Machinery Co** announces that **O J Neslage** has been appointed general sales manager, and **J N Rolston** has been appointed assistant general sales manager.

Young Radiator Co announces the appointment of **A R Johnson,** who will maintain offices in Long Beach and Los Angeles, Calif., as sales and engineering representative in the California territory. . . . **The General Refractories Co** of Philadelphia has purchased the assets of the **Refractories Corp** of Los Angeles, Calif. From now on the plant

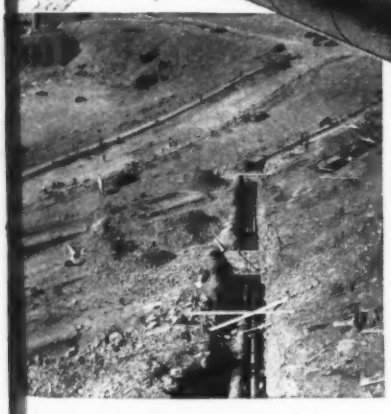
RIC-WIL FURNISHED MORE THAN 25,000 FT. OF PREFABRICATED INSULATED PIPE CONDUIT





For Terrace Village Housing Unit No. 2 in Pittsburgh

Fuel savings of 15% or better are made possible in this mammoth project by a central heating system. Ric-wiL pre-fabricated pipe units provide the insulation and protection for the entire underground distribution system.



ine of Ric-wiL conduit from anchor to boiler ouse (top, left). Note shallow, narrow trench.

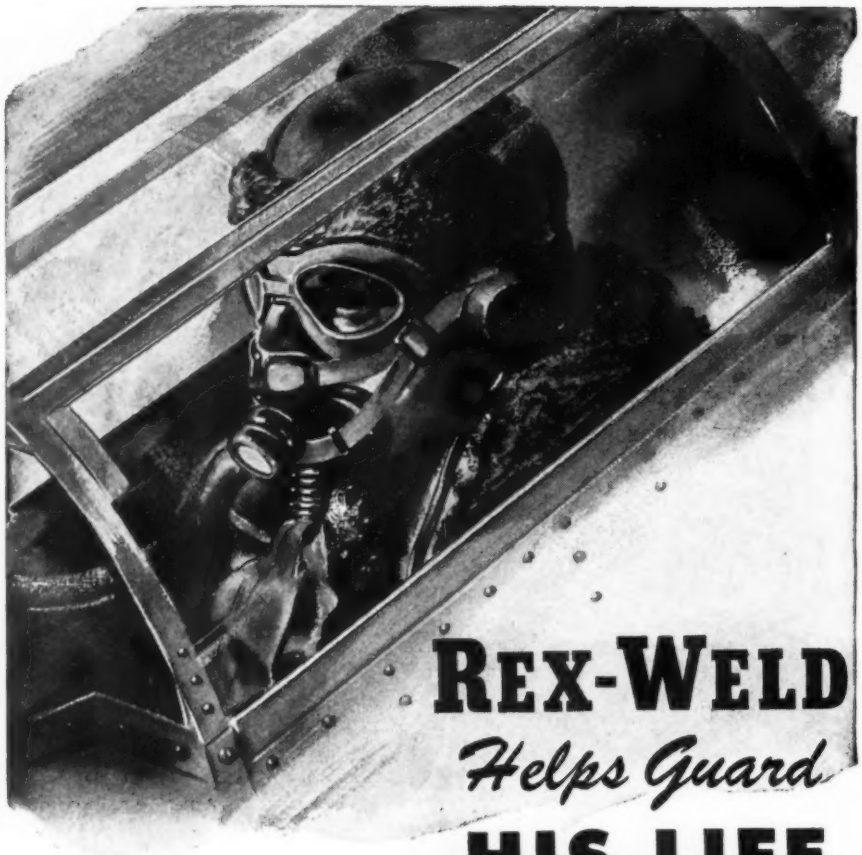
talling connector band. All necessary acces- ries are prefabricated and shipped with order.

A total of 83 buildings, comprising 1851 living suites, are supplied with heat and hot water from a central plant, through an underground distribution system containing over 25,000 lineal feet of Ric-wiL pre-sealed Insulated Pipe Units. High-pressure steam from the plant is piped through Ric-wiL steam conduit to six scattered stations where hot water is generated and circulated through Ric-wiL conduit to all the buildings, for heating and hot water supply. Thus the project realizes the economy of steam, and the temperature control and convenience of hot-water heating.

All conduit was factory pre-fabricated and shipped pre-sealed to the site in convenient lengths. Installation was made in record time, with a minimum of excavation and backfill, saving countless man-hours and interfering little or none with other construction. The system is highly efficient, permanent, and maintenance-free—typical of all Ric-wiL engineered projects.

Ric-wiL Insulated Pipe Units are ideal for hospital, school, industrial or municipal installations of all kinds. Let us show you their advantages on your next construction project.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES



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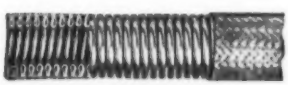
Helps Guard
HIS LIFE

REX-WELD Flexible Metal Hose has met the critical test that demands only the best materials for our combat planes. More and more bombers, fighters and interceptor-pursuit ships are being Rex-Weld equipped.

REX-WELD's war service is not confined to the planes themselves. In the steel mills and munition factories, on the production and assembly lines, everywhere that war-worthy flexible connections are needed, REX-WELD is rendering vital service.

There are specific reasons for this. REX-WELD is a specially constructed flexible metal tubing. It is fabricated from strip metal by a precision autogenous welding process that produces uniform, stronger wall structure plus extreme flexibility. REX-WELD stands up under high pressures, high and low temperatures, extreme contraction and expansion. It is seep-proof to gas, water, oil, air and searching fluids.

Type RW-81
(annular corrugations)



Type RW-91
(helical corrugations)

Available in continuous lengths to 50 ft. Both Steel and Bronze. 3/16" I. D. to 4" I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F.

Write for Engineering Recommendations

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Illinois

of this concern in Los Angeles will be operated as a unit of the General Refractories Co.

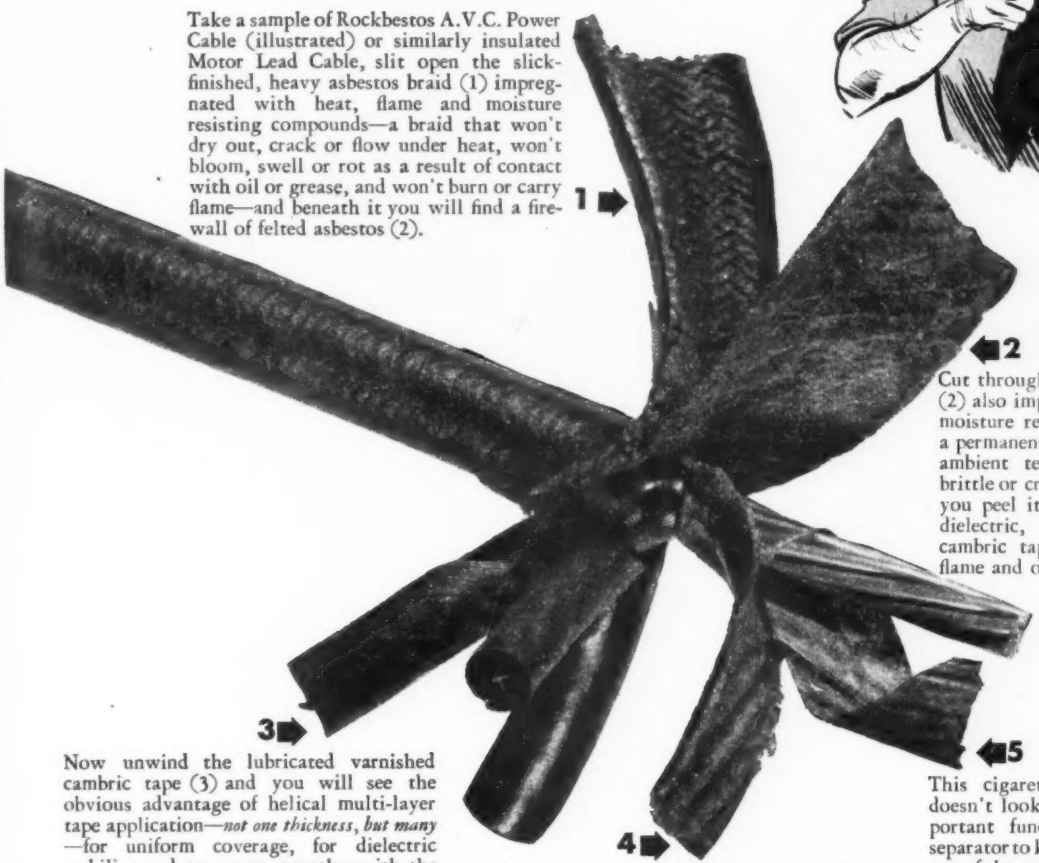
The Johnston & Jennings Co, 864 Addison Road, Cleveland, Ohio, has purchased the exclusive manufacturing and sales rights of Rusta-Restor, a cathodic process for preventing rusting of water tanks, piping and similar steel structures which has been tested and approved by the **American Water Works Association, Factory Mutual,** and other laboratories. . . . The annual sales meeting of the **Superior Engine Division** of the **National Supply Co** was held at the factory in Springfield, Ohio, February 15-18. The meeting was directly in charge of **A S Campbell,** sales manager of the Superior Engine Division, under the supervision of **A W McKinney,** vice-president in charge of sales of the National Supply Co. . . . **Globe Steel Tubes Co** announces that **C J Bickler** has been appointed assistant to the vice-president, sales, with offices at Milwaukee, Wis. Mr Bickler was formerly sales manager of the Cleveland district. . . . **Sylvania Electric Products, Inc,** announces the election of **Walter E Poor** as president, succeeding **B G Erskine,** now chairman of the board. **Noel E Keeler,** controller and assistant treasurer, has been made treasurer, and **Philip P Borden** has been named assistant treasurer. Mr Poor has been a director of the company since its incorporation in 1917.

Neil C Hurley, Jr, was elected executive vice-president of the **Independent Pneumatic Tool Co,** April 8. Mr Hurley has been associated with the company for eleven years, serving the past four years as vice-president and director . . . Three executive promotions were announced by **S F Wollmar,** executive vice-president of **SKF Industries, Inc. Thomas W Dinlocker** was elected vice-president and treasurer; **Richard H DeMott,** vice-president in charge of sales, and **C P Collins,** secretary. **William L Batt,** vice-chairman of the War Production Board, retains the presidency . . . **The Standard Manufacturing Co** of Corning, N. Y., has moved to its new plant in nearby Big Flats, N. Y., and the name of the organization has been changed to **Hungerford Corp.**

Bureau of Reclamation power plants provided 70% of the generating capacity added in 1942 to speed war production in the 11 far western states, according to a recent announcement by Secretary of the Interior, Harold L Ickes.

GET THE INSIDE STORY... APPLY THE KNIFE-TEST TO ROCKBESTOS A.V.C.

Take a sample of Rockbestos A.V.C. Power Cable (illustrated) or similarly insulated Motor Lead Cable, slit open the slick-finished, heavy asbestos braid (1) impregnated with heat, flame and moisture resisting compounds—a braid that won't dry out, crack or flow under heat, won't bloom, swell or rot as a result of contact with oil or grease, and won't burn or carry flame—and beneath it you will find a fire-wall of felted asbestos (2).



2 Cut through this felted asbestos firewall (2) also impregnated with heat, flame and moisture resisting compounds to provide a permanent protecting wall against high ambient temperatures that won't bake brittle or crack with vibration, and when you peel it back you will see the high-dielectric, moisture-resistant varnished cambric tape (3) it protects from heat, flame and oxidation.

3 Now unwind the lubricated varnished cambric tape (3) and you will see the obvious advantage of helical multi-layer tape application—*not one thickness, but many*—for uniform coverage, for dielectric stability and to assure, together with the helically applied felted asbestos, perfect and permanent centering of the conductor in the insulation.

4 Under the tapes you will notice another felted asbestos firewall (4). An inner heat-barrier to complete the protection of the varnished cambric, put there to prevent the heat of overloads from attacking the tapes. It won't ignite or burn even when exposed to copper-melting arcs. Now slit this felted wall and peel it back, and you'll see beneath a thin layer of paper (5) over the conductor.

5 This cigarette-thin layer of paper (5) doesn't look like much but it has an important function. It is employed as a separator to keep insulation and compounds out of the conductor so that it will be clean and strip easily. And that completes the story of the construction of Rockbestos A.V.C. *the wire with permanent insulation.*

Try the simple test outlined above on a sample of Rockbestos A.V.C. wire or cable of your selection, which we will send on request, and you'll readily see why *permanently insulated* Rockbestos resists heat, flame, moisture, corrosive fumes, oil and grease—and gives long-lived service under high operating temperatures and severe conditions.

Rockbestos A.V.C. Power and Motor Lead Cables and Lighting Wire (Underwriters' and National Electrical Code, Type AVA) have a maximum operating temperature rating of 110° C. (230° F.), and will not bake brittle, crack, bloom, swell or rot. Send for a sample and make your own jack-knife test. Write to us at New Haven or the nearest branch office:

ROCKBESTOS PRODUCTS CORPORATION
911 Nicoll Street, New Haven 4, Connecticut

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

FOR VICTORY ★ Invest in United States War Bonds ★

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Here is a BETTER Strainer to "police your pipelines"

- **FIRST**—*The Screen*, a high-grade woven Monel wire basket that catches solids—lets condensate, oil or other fluids flow freely.
- **SECOND**—*Finish.* Cadmium plated inside and out for protection against corrosion.
- **THIRD**—*Easily Cleaned.* Blow-off bushing made for easy removal. Bushing and Screen come out together. Screen automatically aligns on reassembly.
- **THOUSANDS IN SERVICE**—Sold by over 100 Mill Supply Houses.

6 sizes from ½" to 2" for pressures up to 600 lb. Reasonably priced.

See your supply house or write for Bulletin S-200.

YARNALL-WARING COMPANY
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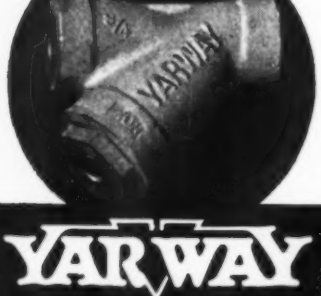
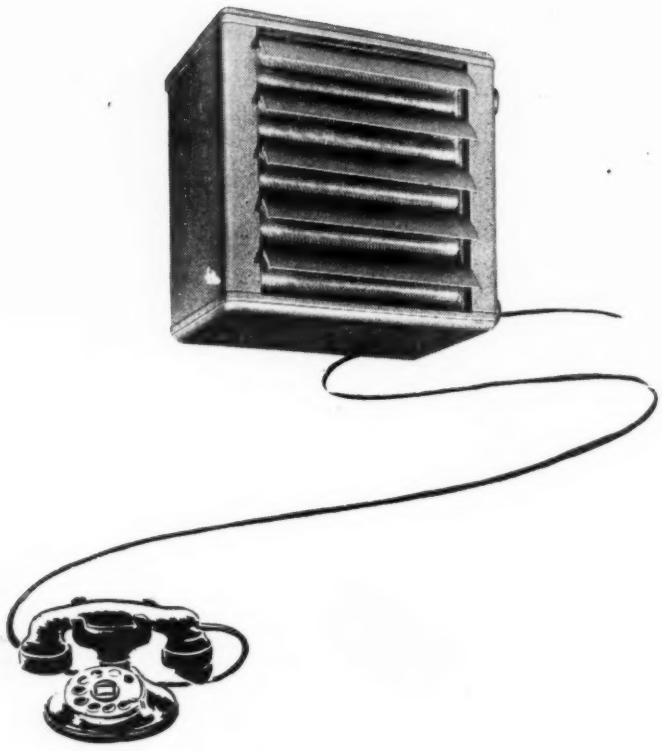


YARWAY STRAINERS



Let's talk Sense... Men who do business with Fedders have found that a promise is a promise. Through maintaining a sensible balance between backlog of orders and ability to produce, we have made friends by making deliveries that heating men can depend on. You will enjoy doing business with Fedders . . . even under these emergency conditions.

FEDDERS MANUFACTURING CO., INC., BUFFALO, N. Y.

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Manufacturers of Unit Heaters, Blast Heating Coils, Unit Coolers, Electric Refrigeration Equipment, Automotive and Aircraft Radiators, Electric Water Coolers

This is Synthetic Rubber

Synthetic rubber is a new basic raw material which is processed, treated and formed in much the same way as natural rubber. And...like natural rubber...it is of different types, is capable of many variations.

Synthetic rubber is manufactured from gasoline, alcohol, coal and gases kept liquid under pressure and is now being made in five basic commercial types. Each type has distinct properties and characteristics that fit it for specific tasks. For some, synthetic rubber is superior to natural rubber. For others it is equally as good.

To determine which synthetic rubber is right for the job, however, requires a really thorough knowledge of rubber chemistry. The manufacturer must be familiar with the properties of all five commercial types . . . Buna-S, Buna-N, Neoprene, Thiokol and Butyl.

United States Rubber Company uses all five basic types of synthetic rubber and is thoroughly familiar with the characteristics, properties and suitability of each type to the task for which it is intended. As the nation's largest user of synthetic rubber, "U.S." has built up a tremendous backlog of knowledge of this new basic raw material and experience in processing synthetic rubber to handle a certain definite job. Today, this knowledge and experience are being drawn upon to the fullest in supplying the Armed Forces and war industries with the synthetic rubber and synthetic rubber products they need.

A copy of "The Five Commercial Types of Synthetic Rubber" will be a valuable addition to your files.

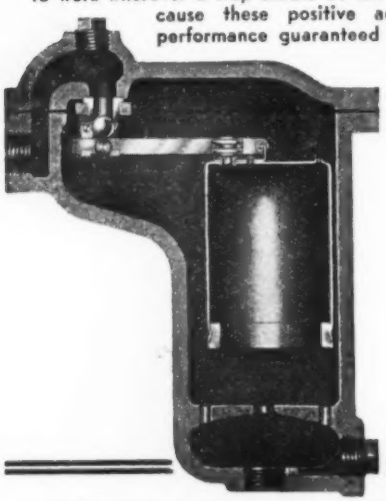
Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

1230 Sixth Ave., Rockefeller Center, New York 20 •

UNITED STATES RUBBER COMPANY

*USE A – **CRYER** – STEAM TRAP WHERE THERE'S THE MOST TROUBLE and you'll equip all your lines*

Every Cryer Trap you install is just another reason why you'll want to put one to work wherever a trap should be used because these positive acting, performance guaranteed traps will cure all trap troubles wherever they can possibly occur. Air binding, slow venting, dribbling, poor drainage are "out" wherever a Cryer goes "in."



Features include: easy installation—easy cleaning—premature raising of bucket eliminated—quick venting and rapid discharge regardless of temperature—strong brass bucket—easily removed stainless steel seat—correct seating of stainless steel ball assured—inspection of operation and removal of all mechanism possible without disconnecting piping.

INVESTIGATE TODAY

Write at once for Bulletin giving complete detailed information.

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Made in sizes from ½" to 2½" inclusive; in capacities from 500 to 38,000 lbs. of water; for pressures from 0 to 250 lbs.

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We carry all sizes of traps and repair parts for the line formerly known as J. M. Ball Steam Traps.

CRYER TRAP AND VALVE CO., INC.

MANUFACTURERS OF STEAM SPECIALTIES FOR MORE THAN 40 YEARS

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THE PACKING THAT "PACKS ALL"

. . . use it once and

. . . you'll use it always

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

THE ALLPAX CO., INC.

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Quality Ⓛ **Fittings**

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LADISH DROP FORGE CO.

CUDAHY [MILWAUKEE SUBURB] WISCONSIN

The pre-war engineering job of planning, specifying and installing valves has changed to what might be called "re-engineering" — that is *re*storing, *re*arranging and *re*-using valves already on hand. For this re-engineering, Ludlow is always glad to give aid. The working parts of valves, usually the first to wear out or be damaged, can in many cases be replaced and the valve put back into service. Ludlow Valves are dependable and long-lasting, and it is quite possible that old valve bodies in a storehouse corner may be used with the restoring of a part or two. Check up, get a priority, and send in your order. Ludlow will co-operate as always.

THE LUDLOW VALVE MFG. CO., INC.
TROY, NEW YORK

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.

LUDLOW VALVES

SINCE 1866

★ *Back from a bombing mission—an engine missing—a rudder all but shot away. Under trees, on sandy deserts, our skilled Air Corps mechanics are "keeping 'em flying"—within earshot of enemy guns.*

Get 'er *Flying* in a hurry

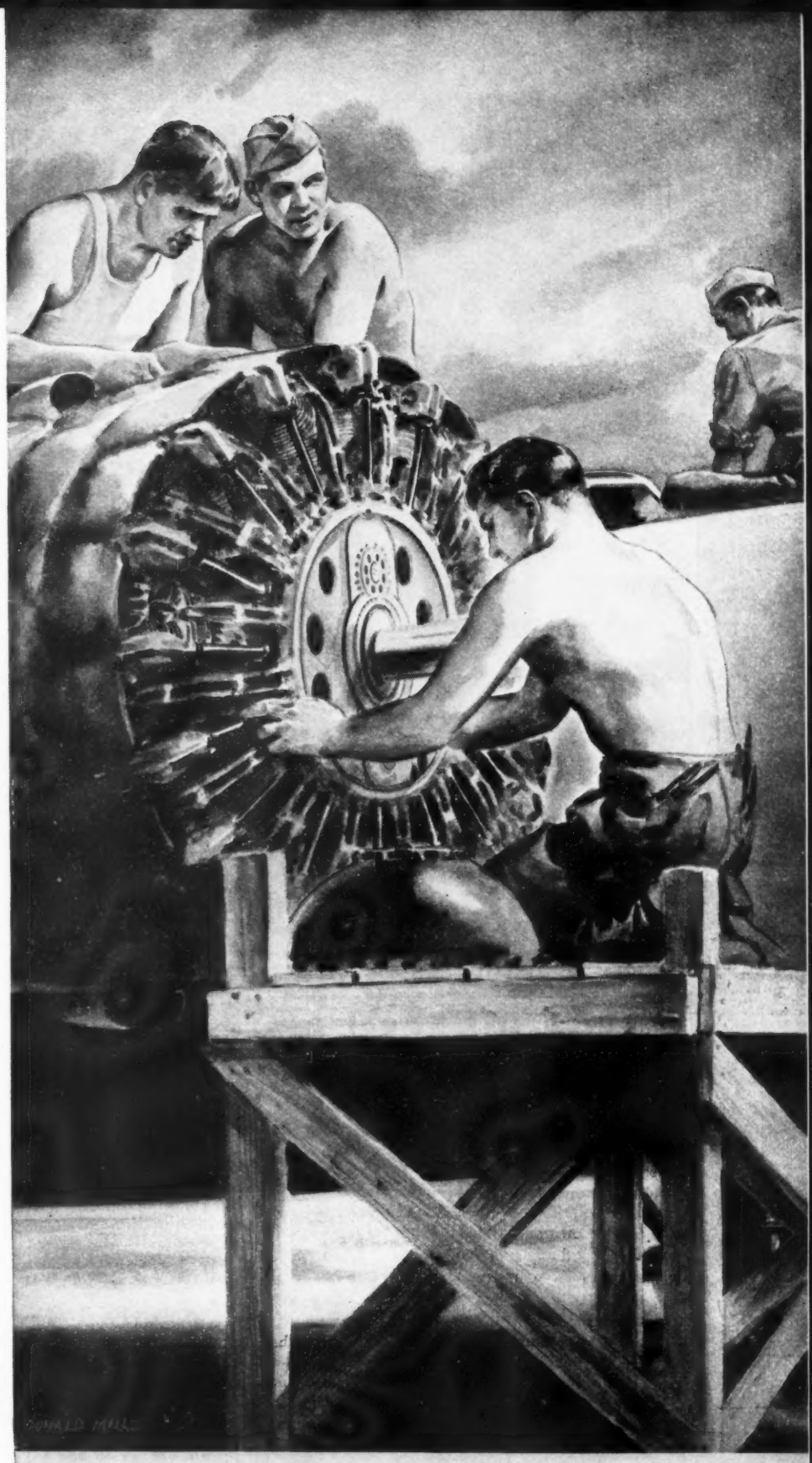
When a mission must be carried out, there is no time to baby an airplane! The machine shop may be under a tree with the sky for a hangar roof, but the orders are: "Get 'er flying—in a hurry!"

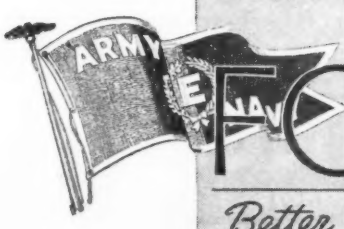
It takes a tough ship to stand the daily pounding these missions entail. It takes a tough engine to keep that ship flying with minimum time out for repairs and overhauls. And this is the job that Pratt & Whitneys are performing—a job that is writing their fame in smoke and fire over Axis-ruled lands.

But the toughness of these engines comes, not from rugged construction—not from "beefed up" parts, but from the close tolerances to which every part is held—a precision that makes possible great strength coupled with lightness.

The lightweight precision gears that have been developed for this engine—gears that are today being made in huge quantities at Foote Bros.—give promise to American manufacturers of new efficiency and new economy in the transmission of power when the war is won.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 S. Western Boulevard • Chicago, Ill.





FOOTE BROS.

Better Power Transmission Through Better Gears

Like a 24-hour Watchman At Every Transformer

ONLY SAFER!

MAGNETROL

PATENTS PEND TRADE MARK

Low Oil Level Alarm

• A clever saboteur might elude the most alert guard—but he couldn't escape the constant watchfulness of a MAGNETROL Low Oil Level Alarm. The instant that transformer oil level reaches the danger point, the MAGNETROL rings an alarm bell to warn the operator of trouble—in time to prevent costly damage to invaluable equipment.

Especially now, with the Nation's war effort so dependent on an uninterrupted flow of power, Magnetrol protection is indispensable. Incorporating the time-proved magnetic operating principle, this alarm is thoroughly dependable. Without bellows, packing box, electrodes or diaphragms to get out of order, it gives positive protection against the danger of low oil levels whether caused by treachery, carelessness or mechanical trouble.

Install one on every oil-filled transformer as part of your program to "Keep Power Flowing." The cost is insignificant, compared to the value of the equipment protected. Write today for full data.

GREEN LIGHT— *All's Well*

Normal oil level is indicated by a constantly glowing green light. If the circuit is interrupted or oil level drops for any reason, the MAGNETROL switch extinguishes the light, giving the operator a VISUAL sign of trouble.

BELL RINGS— *Danger Threatens*

To make doubly sure of the operator's attention, low oil level also rings a warning bell to provide AUDIBLE signal. The bell continues to ring until the warning is heard and the trouble is corrected. At unsupervised stations, the MAGNETROL can be wired to interrupt the pilot circuit on the breaker, to give positive assurance against damaged equipment.

MAGNETROL, INC.

673 N. Orleans Street, Chicago 10, Illinois

BRICKSEAL

Protects The SURFACE Saves The BRICK

• Forms a highly-glazed Vitrified, Monolithic Surface

A simple application of Brickseal with brush or spray gun, protects your refractories against cracking, spalling and deterioration due to sudden changes in temperature, slagging, clinkering, and flame abrasion.

Boiler is ready for operation immediately after application of Brickseal. Heat of furnace vitrifies Brickseal permanently into all pores, cracks and joints, and forms a highly-glazed, monolithic coating. Brickseal cannot crack, peel or blister due to sudden temperature variations because it remains semi-plastic until boiler cools.

Write for sample or Brickseal representative, today.

BRICKSEAL REFRACTORY CO.

1029 CLINTON ST., HOBOKEN, N. J.

More than . . . a printmaking process

WITH an Ozalid machine you make whiteprints direct from your engineering drawings in two fast steps—Exposure and Dry Development . . . the most simple method on record.

The Model B illustrated here is designed for large-scale production; turns out prints at speeds up to twenty feet per minute. →

OZALID CUTS DRAFTING TIME

You can make design changes quicker with Ozalid.

Using an Ozalid transparent print of the original—it's never necessary for the draftsman to redraw any line which remains the same in the new design . . . it's never necessary to employ photographic equipment . . . or to otherwise throttle production.

Ozalid transparent prints are made in the same manner as standard prints—without Van Dyke tieups. Think what this means considering the number of design changes you're making today—the number you'll be making in the postwar period.

Be sure of a "head start" with Ozalid!

OZALID GIVES THESE EXTRA VALUES

Most Versatility

You can do much more with Ozalid. You can make prints of your engineering drawings, charts, and letters which will have blue, black, or maroon lines on a white background. You can make prints on standard, transparent, and foil materials.

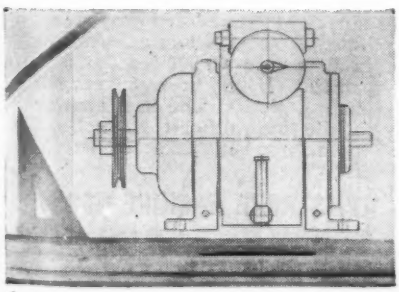
What's more—all Ozalid materials are available in cut sheets, as well as roll stock; thus, by using sheets the size of your originals you can completely eliminate trimming waste.

Low Maintenance Costs

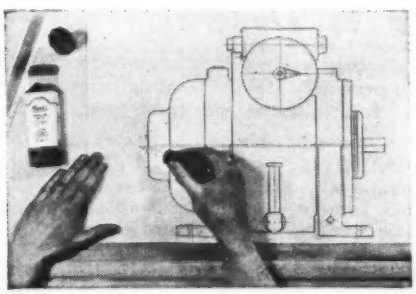
Any inexperienced person can operate an Ozalid Whiteprint Machine. There's never a labor problem, because Ozalid's Dry Development has simplified printmaking—eliminating the liquid baths, the driers, the plumbing connections which demand skilled supervision.

Another result of Ozalid's Simplified Printmaking is low electrical consumption. The Model B, operating at maximum speed, consumes only 4.4 kilowatts.

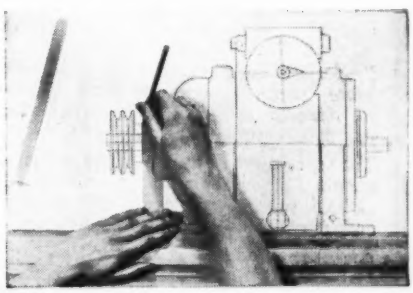
Ozalid Whiteprint Machines are designed for large-scale, medium, and occasional print production . . . and there are dry developing units for those having a suitable printer.



1. **This is** an Ozalid transparent print of an engineering drawing—part of which has to be changed.



2. **The draftsman** quickly eradicates the obsolete lines with a quick-drying corrector fluid.



3. **The new design** is drawn in . . . the desired number of prints can be made from this transparent copy.

OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

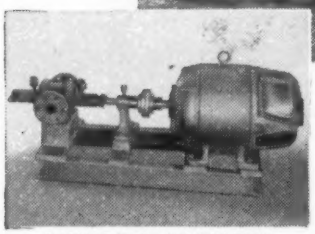
Johnson City, N. Y.

OZALID IN CANADA—HUGHES OWENS CO., LTD., MONTREAL

WRITE FOR CATALOG . . . and sample booklet of Ozalid Whiteprints. See how leading manufacturers save time, labor, and materials with Ozalid.

NAVY'S "WATCHDOG" ...Hunts Axis Submarines To Their Graves!

OFFICIAL U. S. NAVY PHOTOGRAPH



VIKING FUEL OIL DELIVERY PUMP

Another of Viking's War-time jobs is building fuel oil transfer pumps, as pictured here, for use on the U. S. Navy's fast, hard-hitting sub-chasers . . . one of Uncle Sam's best pieces of insurance against Axis submarines.

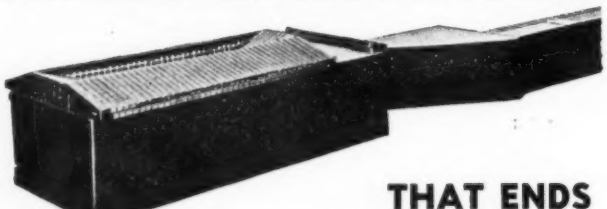
The unit consists of a direct-connected Viking Rotary Pump constructed of marine bronze and powered through a flexible coupling to an electric motor, all mounted on a structural steel base. This unit is also furnished for lube oil transfer, in which case it is back-geared to the motor for reduced pumping speed.

Viking appreciates the patriotism and patience of valued civilian customers who are unable to get Viking Rotary Pumps at all . . . or who get them only after considerable delay. We're all agreed that the U. S. Navy, which is doing such a whale of a job to win the War on the seven seas, comes first today. The sooner our sub-chasers blast the Axis "pig boats" out of the way, the sooner will final Victory permit our Fighting Yanks to come back home.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

THE BURNING END



THAT ENDS MANY COMMON STOKER FAULTS: *engineered by Frederick!*

Frederick Stokers have *more active grate surface,* without dead plates . . . maintain a low combustion rate per square foot of area!

The specially designed tuyeres have air ports so arranged and proportioned as to insure complete air distribution and maximum combustion efficiency.

And, the wind-box is enclosed to simplify and make a neater installation, and to eliminate efficiency loss through leaky brickwork. *Two* cleanout doors are provided to allow thorough cleaning *both sides* of the grate area.

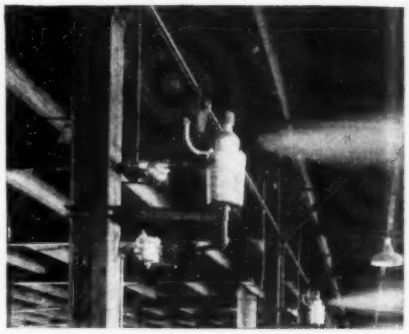
Yes, the new Frederick Stokers are DIFFERENT! A long list of original features distinguish them. Many common stoker problems are solved by them. And, if you're looking for maximum thrift, convenience and efficiency, we suggest you investigate. All details upon request; no obligation.

FREDERICK INDUSTRIAL STOKERS

The FREDERICK IRON & STEEL CO.
Eighth and East Sts., Frederick, Maryland

Centrifugal Pumps for All Purposes

MAGICAL EFFECT . . . on human comfort



and Efficiency with Armstrong HUMIDIFICATION plus reduction in static and drying out of materials

AUTHORITIES AGREE that dry air in plants and offices cuts working efficiency to a surprising degree, encourages winter colds, and favors dust and static. Now you can eliminate this source of absenteeism and lowered efficiency simply, quickly and economically by installing Armstrong HUMIDIFICATION. Other advantages: Prevents warpage and checking of wood, shrinkage of paper, spoilage of foods, cracking of leather, weight loss, and other evils of dry air.

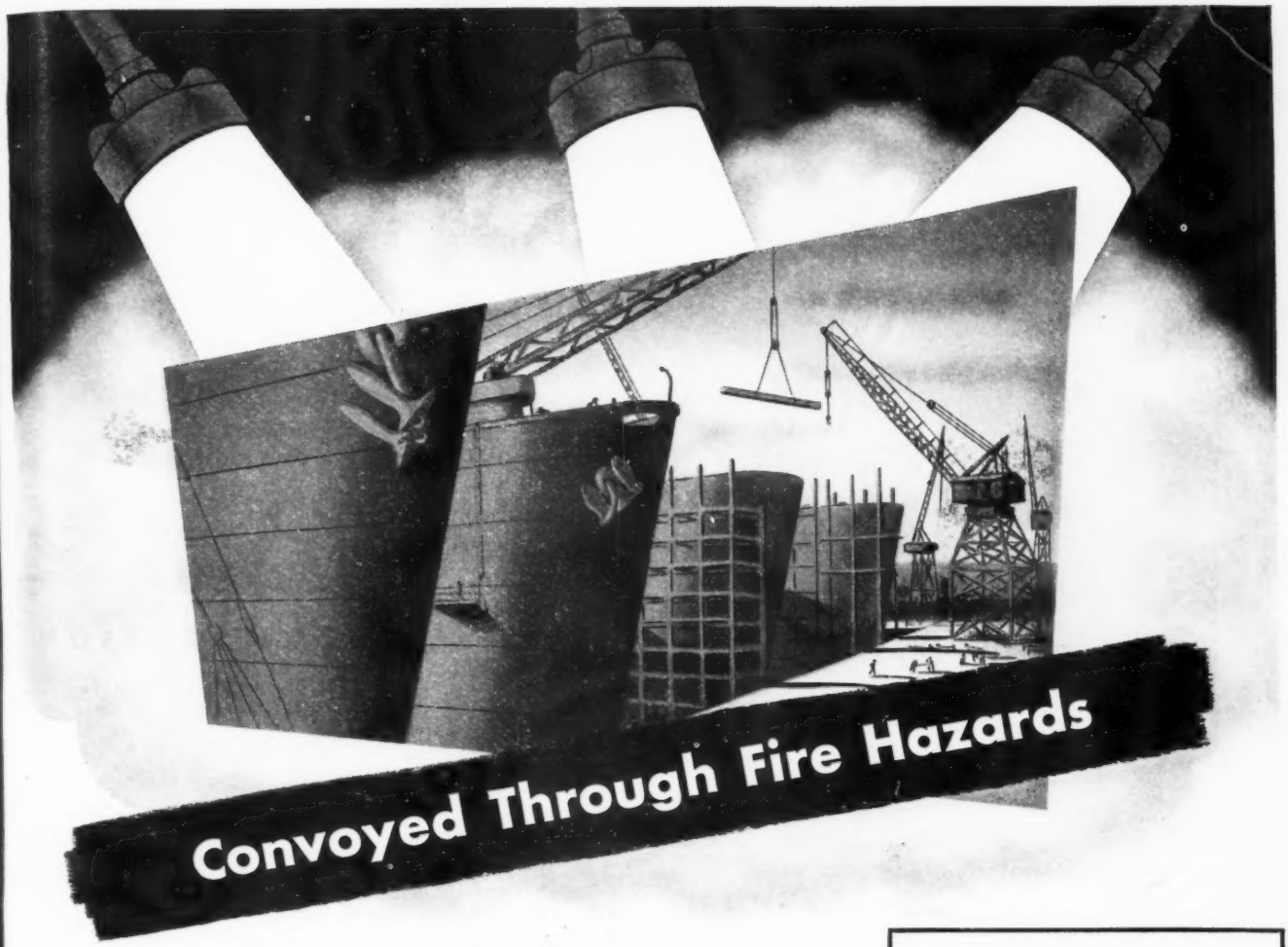
Simple, quiet, practical, high capacity; connected to steam lines like a unit heater. As low as $100 for 40,000 cu. ft. capacity. Used in hundreds of leading plants. The best answer to the humidification problem on the market. Ask for literature.

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Mich.

AS LOW AS 2 CENTS PER HOUR!

Write for Bulletin

ARMSTRONG STEAM TYPE HUMIDIFIERS



by CARDOX Fire Extinguishing Performance

Beating the U-boat menace is only one —the final—phase in solving America's shipping problem. Before a battle wagon, flat top, freighter or troopship is ready for its vital job on the high seas, it must be convoyed through shipyard fire hazards.

Vital tons of shipping are serving the United Nations today that might still be only a hope except for Cardox Fire Extinguishing performance that guarded them against fire hazards during construction.

In addition, engineered applications of Cardox Fire Extinguishing Systems are playing a vital "convoying" rcle in war plants—large and small—producing such necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents, Motor Fuel, Electric Power.

Cardox Fire Extinguishing Systems give fast complete extinguishment. Timed, mass discharges of *pounds* or *tons* of cold, inert carbon dioxide smother and "cool out" large or small fires. Since there is no damage by the extinguishing medium, time out for repair of plant and equipment is reduced to a minimum.

In addition to producing individual applications of Cardox Fire Extinguishing Systems to protect a wide range of war industries, Cardox is working with industry on new improvements in fire protection to help build a better post-war world.

For further details, write on your company letterhead for Bulletin 993.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in New York • Washington Detroit • Cleveland • Atlanta • Pittsburgh San Francisco • Los Angeles • Seattle

How Cardox Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

PURE WATER... INEXPENSIVELY

Shown above is a single effect of a typical Henszey Distillation System.

The *supply* of water is not usually a problem but the *quality* of the available water usually is. That is because the high salt content renders some water supplies unfit for industrial processing —for boiler feed water— and for human consumption.

HENSZEY DISTILLATION SYSTEMS

provide an abundant supply of absolutely pure water— and at a low cost, because the Henszey unit gives six effect efficiency with only three evaporator effects. Fuel consumption is cut in half. Installation space requirements are held at a minimum.

If you are the man whose job it will be to provide pure water for power production —for industrial processing— or for human consumption— you should know more about Henszey Distillation Systems.

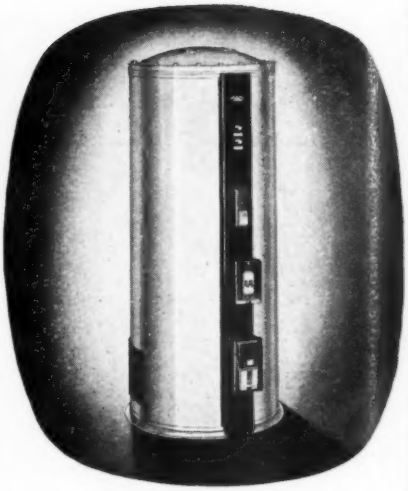
HENSZEY CO. Dept. D9, Watertown, Wis.

HENSZEY

DISTILLATION SYSTEMS

Continuous Blowdown • Heat Exchangers • Boiler Feed Regulators

Feed Water Meters • Flow Indicators • Proportioning Valves



Successful PURIFICATION

of all types of Industrial oils is guaranteed by

HONAN-CRANE "CONTINUOUS" OIL PURIFIERS

Honan-Crane *"Continuous"* Oil Purifiers are now operating in every field where oil is being used. We can give you complete information as to the technique of application and the results accomplished by the purification of any kind of Industrial Oil.

COMPLETE LIBRARY ON OIL PURIFICATION — The following material can be obtained by writing on your company letterhead:

BULLETIN 100M—Purification of lubricating oil for Gas and Diesel engines up to 10,000 H. P.

BULLETIN 300T—Purification of lubricating oil for Turbines and Hydro-Electric Generators.

17 ENGINEERING BULLETINS with the latest information on purification of: Hydraulic oils, Insulating oils, Cutting oils and coolants, Diesel Fuel oils, Roller Backup oils, Compressor oils, Ice Machine oils, Quenching oils, Honing and Lapping oils, Switch oils, Power Transmission oils, Treated Turbine oils, Bearing oils, Engine Test and Run In oils, Oil Purification Temperatures, Cranite Refill Element.

Honan-Crane
CORPORATION
1200 SIXTH STREET
LEBANON, INDIANA

HEAT INTERCHANGE AND VACUUM EQUIPMENT

For Every Power Plant Need

As a major producer of heat interchange equipment, Lummus designs and builds a complete line of

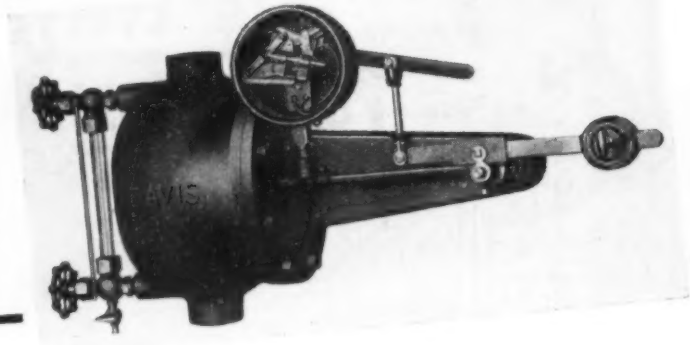
★ Surface Condensers
★ Steam Jet Air Pumps
★ Bleeder Heaters
★ Boiler Blowdown Heat Exchangers
★ Evaporators
★ Fuel Oil Heaters
★ Lubricating Oil Coolers

The services of Lummus engineering personnel are available to public utilities and industrial power plants for the study of specific problems and the design of heat exchange and vacuum equipment to meet individual conditions.

THE LUMMUS COMPANY • 420 LEXINGTON AVE., NEW YORK 17, N.Y.

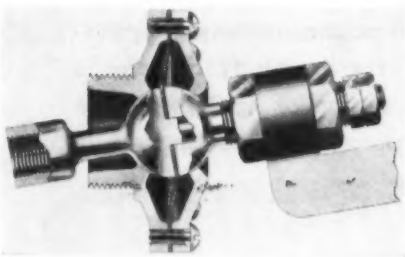
LUMMUS

DAVIS FLOAT BOXES
MAKE LIQUID LEVEL CONTROL POSITIVE AND DEPENDABLE



Davis Float Boxes are used where the liquid level in a closed tank is the governing factor in control of valves, switches, motors and other devices. They can be supplied with all types of electrical switches, and air pilots as well as for mechanical connection to valves or other equipment. Combinations of Davis Float Boxes and Davis Control Valves are available to meet any needs. Other Davis fluid control equipment includes internal float units for direct, or pilot operation.

The Float Box illustrated above is No. 164 with mercury tube switch. ASK FOR BULLETIN 101-A.



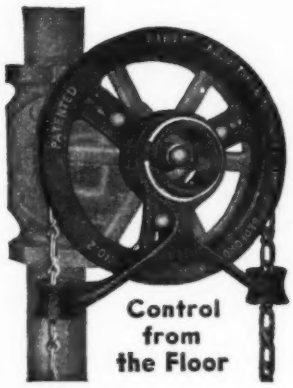
DAVIS "DIA-BALL" TRANSMISSION UNIT

A patented leak-proof, corrosion resistant, packless assembly available in place of the packing box on Davis Float Boxes. Especially recommended for vacuum service or where volatile or inflammable fluids are involved. Extremely dependable and trouble-free.

DAVIS REGULATOR COMPANY

2540 S. Washtenaw Ave. **Chicago, Illinois**

Make Your Overhead Valves SAFE And Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

Coming in
December POWER
"THE POWER ENGINEER'S HANDBOOK"

Part I — 32 pages of useful, hard - to - find - when - needed tables, charts, graphs.

WATCH FOR IT!

Cities Service Announces

A NEW ENGINEERING SERVICE FOR DIESEL OPERATORS

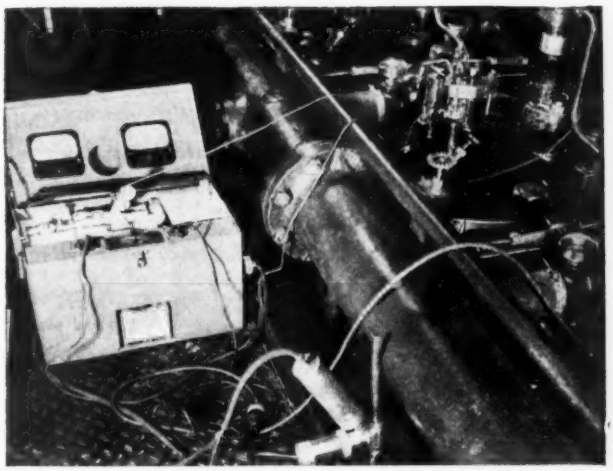
CITIES SERVICE **DIESEL HEAT PROVER** TEST SHOWS OPERATORS OF A. C. DIESEL GENERATORS THESE VITAL POINTS

1. INDIVIDUAL CYLINDER H. P. OUTPUT.
2. INDIVIDUAL CYLINDER COMPRESSION.
3. INDIVIDUAL CYLINDER PEAK PRESSURES.
4. FUEL INJECTION TIMING.
5. MECHANICAL CONDITION OF PISTON AND RINGS.
6. EXACT FUEL ECONOMY.

To help Diesel operators obtain the greatest possible production at the lowest possible operating cost—Cities Service introduces a scientific new "HEAT PROVER" engineering service.

Through this new "HEAT PROVER" service it is now possible for you to determine exactly the operating efficiency of your Diesel equipment and to make any necessary adjustments long before trouble ever starts. This service is available on request, in most of the important industrial cities East of the Rocky Mountains.

Tests already have resulted in considerable savings in fuel and overhaul costs to many operators. So to make sure your Diesels are in perfect working order, ask for a DIESEL HEAT PROVER test of your equipment today. There is no cost or obligation. Write to Cities Service Oil Company, Room 1727, Sixty Wall Tower, New York 5, N. Y.

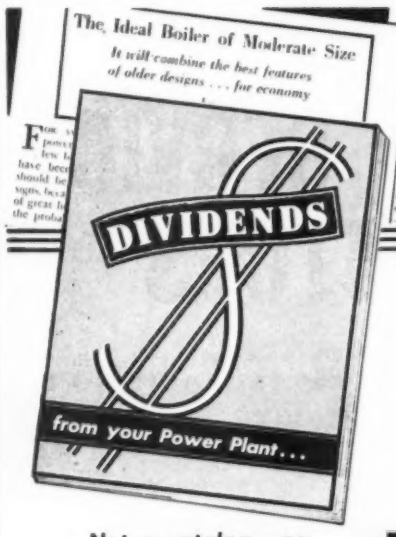


THE CITIES SERVICE DIESEL HEAT PROVER is easily portable—can be used without interrupting operation of equipment. Here it is connected with the engine's generator—and is being used to take a sample of gas at the exact moment when an exhaust port opens.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OIL COMPANY
NEW YORK • CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.


The Ideal Boiler of Moderate Size
It will combine the best features of older designs . . . for economy
If Steam Were a Raw Material
it would get the attention it deserves from plant managers
The Engineer is a Gold Mine
but you may have to dig for the ore
by
Gerald E. De Steen
DIVIDENDS
from your Power Plant...

Written for You . . .

Not a catalog—no advertising—no sales talk—just IDEAS!

PLANT MANAGER — POWER ENGINEER —

***This New Book of Money-Saving Information* FREE!**

HELP for the manager in ascertaining the true relation of his power plant to his profits. Help for the engineer in interesting the manager seriously in power plant economy.

"Dividends From Your Power Plant" is a compilation of readable, non-technical discussions of power plant operation, maintenance, costs, by men who KNOW steam. For example, read on page 4, how a boiler 100% physically sound can be 100% bad economically.

On page 8, how to use the engineer's knowledge and experience to best mutual advantage.

On page 17, the real relationship between steam costs and plant profit.

On page 27, about ingenious inventions and improvements increasing power plant efficiency made by resourceful engineers on the job.

This helpful book—36 pages—is published solely as a service to plant executives, owners, engineers. Your copy is ready. Send the coupon along NOW.

PREFERRED UTILITIES
COMPANY, INCORPORATED
MANUFACTURERS OF UNIT STEAM GENERATORS

MAIL THIS TODAY

Preferred Utilities Co., Inc.
33 West 60th St., New York 23, N. Y.

Yes—please mail me my copy of "Dividends From Your Power Plant"

NAME.....

COMPANY.....

ADDRESS.....

P-943

Look at the
INSIDE STRANDS
when you buy
PACKING

Ordinary packings are merely dipped in lubricant after braiding, plaiting or twisting. The result . . . such packings soon lose their lubricating quality, dry out, and score the rod, shaft or stem.

Not so with PALMETTO and the other G-T Self-Lubricating Packings. *Each individual strand* of these packings is separately impregnated by a special lubricant, while hot and under pressure, *before* braiding, plaiting or twisting.

G-T Packings, therefore, come to you literally *saturated* with lubricant. That's why these packings remain soft and pliable for long periods . . . protect shafts, rods and stems . . . reduce annual packing expenditures and stuffing box maintenance costs. You are SAFE when you buy G-T Packings, and there's an exactly suitable style for every fluid.

WRITE FOR LITERATURE

BRAIDED
For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.

TWISTED
For valve stems, each strand a perfect piece of lubricated packing.

GREENE, TWEED & COMPANY
Bronx Blvd. at 238th St., New York 66, N. Y.

PALMETTO
for steam, hot water, air. PALCO *for water.*
PELRO *for oils.* CUTNO *for alkalis.*
SUPERCUTNO *(blue asbestos) for acids.*
KLERO *for foods.*
SELF-LUBRICATING
PACKINGS

BEFORE YOU SPECIFY A VALVE
Make Sure It is the One You Need

TODAY, when it is more important than ever before to keep pipe lines flowing at maximum efficiency, too much care cannot be given to selecting the right valve for each job. Before you "draft" a valve for that all-important line, make sure it is the one you really need.

Here is the answer to a frequently-asked question on valve selection, taken from the files of The Kennedy Valve Manufacturing Co. Other problems will be considered in succeeding advertisements in this series.

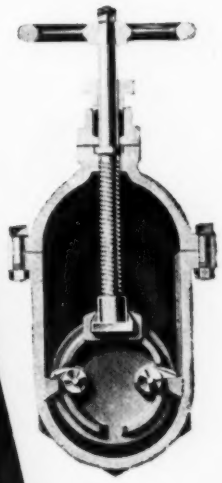


Fig. 2

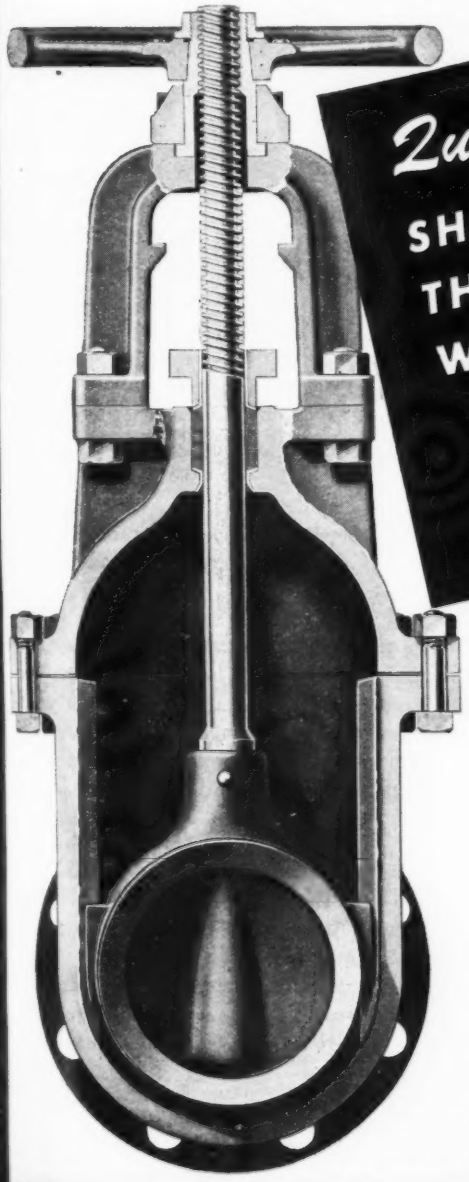


Fig. 1

Question:

SHOULD YOU USE VALVES THAT SHOW AT A GLANCE WHETHER THEY ARE OPEN OR CLOSED?

Answer:

The rising-stem of outside-screw-and-yoke gate valves provides visual indication of disc position (see figure 1). Whether or not this construction should be chosen depends on installation conditions and the fluid being handled. Rising stems require more headroom, and the external threads are exposed to atmospheric conditions, although this is not a serious drawback in most cases as the threads are easy to lubricate. Non-rising stems (see figure 2) do not require additional headroom but, because disc position is not apparent to the eye, excessive operating strains may result from attempting to turn the handwheel in the wrong direction. The outside screw is preferable with corrosive fluids because the stem threads are out of contact with the substance handled.

If you have a valve selection problem, write to us. As Kennedy makes a complete line of standard gate, globe, angle and check valves, you can be sure of receiving unbiased help. For full description of Kennedy valves, pipe fittings and fire hydrants, send for 240-page Kennedy Catalog.

KENNEDY

VALVES • PIPE FITTINGS • FIRE HYDRANTS

THE KENNEDY VALVE MFG. CO. • ELMIRA, N. Y.

Your Bond Selling Responsibilities Double!

Starting September 9th, your Government will conduct the greatest drive for dollars from individuals in the history of the world—the 3rd War Loan.

This money, to finance the invasion phase of the war, must come in large part from individuals on payrolls.

Right here's where YOUR bond selling responsibilities DOUBLE!

For this extra money must be raised *in addition* to keeping the already established Pay Roll Allotment Plan steadily climbing. At the same time, every individual on Pay Roll Allotment must be urged to dig deep into his pocket to buy *extra* bonds, in order to play his full part in the 3rd War Loan.

Your now *doubled duties* call for these two steps:

1. If you are in charge of your Pay Roll Plan, check up on it at once—or see that whoever is in charge, does so. See that it is hitting on all cylinders—*and keep it climbing!* Sharply increased Pay Roll percentages are the best warranty of sufficient post war purchasing power to keep the nation's plants (*and yours*) busy.

2. In the 3rd War Loan, every individual on the Pay Roll Plan will be asked to put an *extra two weeks salary* into War Bonds—over and above his regular allotment. Appoint yourself as one of the salesmen—and see that this sales force has every opportunity to do a real selling job. The sale of these *extra* bonds cuts the inflationary gap and builds added post-war purchasing power.

Financing this war is a tremendous task—but 130,000,000 Americans are going to see it through 100%! This is their own best *individual* opportunity to share in winning the war. The more frequently and more intelligently this sales story is told, the better the average citizen can be made to understand the wisdom of turning every available loose dollar into the finest and safest investment in the world—United States War Bonds.

★ ★ ★

BACK THE ATTACK With War Bonds!

This space is a contribution to victory today and sound business tomorrow by POWER

A Tight Joint and Perfect Alignment Assured by Radial Seat

Just as undue wear on auto tires results when the wheels are out of alignment, so unnecessary wear is caused on valve parts when they are not perfectly aligned.

Perfect alignment of all parts of Fairbanks Valve U-01 is assured by the radial seat when valve is taken apart to replace a worn disc. Without sliding or scraping of the surfaces of the seat, the radial seat is drawn to a tight joint by a Union nut. This increases the life of the valve and assures a tight body joint after every assembly.

The slid-on disc holder is so guided that it will not bind or stick regardless of position of valve. The design of the disc nut tends to throttle the action against the disc, thereby prolonging its life. Disc rings of any make will fit into the disc holder.

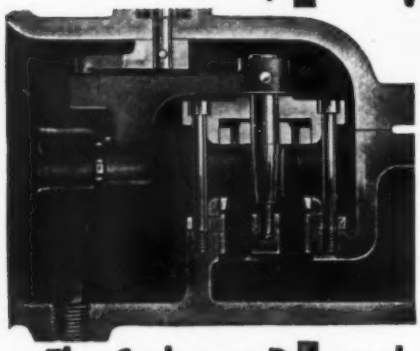
You can "Bank on Fairbanks Valves" for dependable service, long life and low maintenance cost.

Write for catalog No. 42 and name of our nearest distributor.

THE FAIRBANKS COMPANY
393 Lafayette St., New York, N. Y.
Boston, Mass. Pittsburgh, Pa. Distributors in Principal Cities

Fairbanks *Standard and Renewable* **Valves**

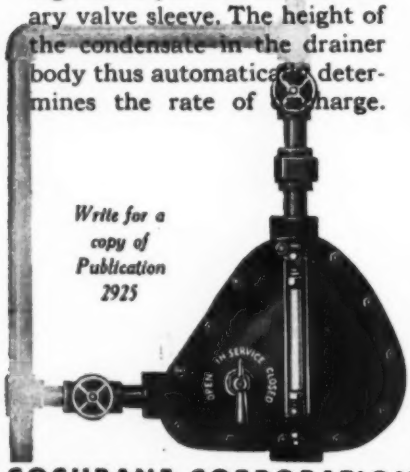
The Secret of this Drainer's Great Capacity



The Cochrane Balanced Rotary Multiport Valve

COCHRANE DRAINERS are famous among power plant operators for their tremendous discharge capacity. Wherever large quantities of condensate must be continuously removed as from evaporators, heaters, separators, coils or steam lines, under vacuum or positive pressures, Cochrane Drainers are specified by experienced plant men. The secret lies in their multiport valve construction, a series of longitudinal parts in the rotary valve matching similar parts in the stationary valve sleeve. The height of the condensate in the drainer body thus automatically determines the rate of discharge.

Write for a copy of Publication 2925



COCHRANE CORPORATION
3706 N. 17th St., Philadelphia, Pa.

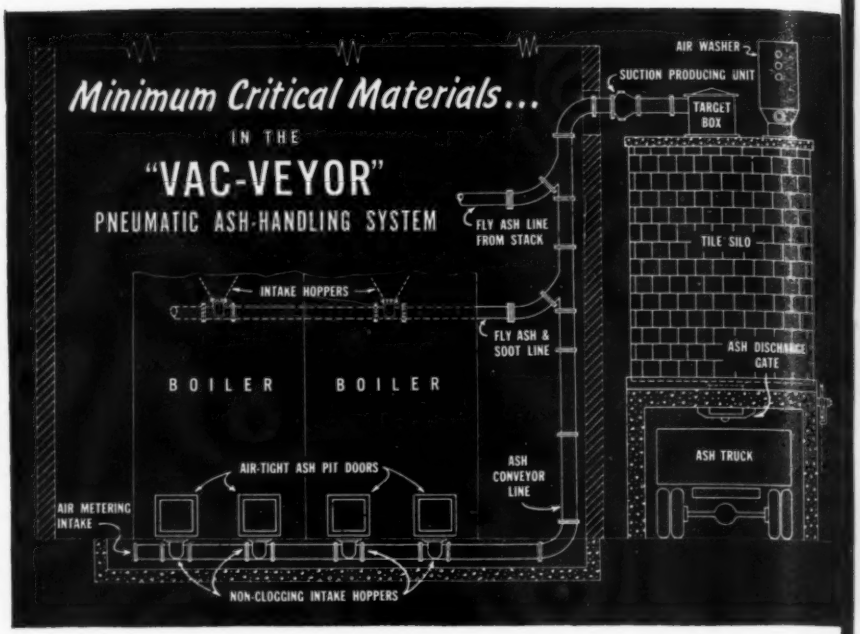
COCHRANE
STEAM SPECIALTIES

Minimum Critical Materials...

IN THE

"VAC-VEYOR"

PNEUMATIC ASH-HANDLING SYSTEM



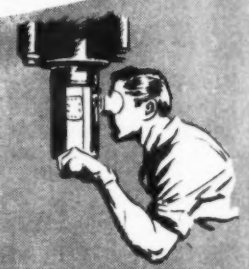
Write us today for complete details

Designed to fill today's needs in either new installations or oil-coal conversion, this pneumatic ash handling system offers numerous advantages.

BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS

DEPENDABLE IN THE PINCHES!



QUIMBY PUMPS

PORTER "Better Built" Equipment
Established 1866

★ SKILFULLY ENGINEERED
★ RUGGEDLY CONSTRUCTED
★ GENEROUSLY PROPORTIONED

Quimby Screw, Rotex, Centrifugal, and Chemical Pumps are designed and built on the principle that a pump's main function is to perform its job with unfaltering constancy. As a result, emergency failure of a Quimby Pump is a rare event.

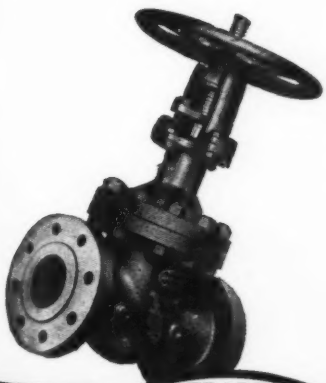
QUIMBY BUILT MEANS BETTER BUILT

QUIMBY PUMP COMPANY
INCORPORATED
DIVISION H. K. PORTER COMPANY, Inc.
PITTSBURGH (1) PENNSYLVANIA

We've Spilled the WORKS!

All the works—two discs and two wedges—four parts—the entire working part assembly of a Darling Double Disc Gate Valve. The seats are parallel. The discs are *fully revolving,* seating in a different position *each time* the valve is operated. This means tighter seating, less wear, longer operation, and lower maintenance costs with Darling Gate Valves. All four working parts are uniform and positive in action. They are simply designed, with no pockets to collect sediment or prevent free and easy movement. Any part can be replaced quickly and inexpensively without removing the valve from the line. They cannot be incorrectly assembled or become disengaged while in service. It's an assembly that will more than pay its way in your plant.

At your service are the engineers of the Darling Valve & Manufacturing Company. They can solve your valve problems without cost or obligation to you. Wire or write, setting appointment at your convenience.



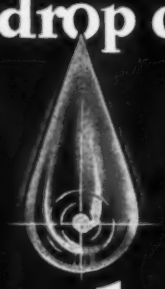
Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

Just a drop of water-



harmless···

or is it?

Although specially treated for use in your water consuming equipment, it may still contain a sufficient amount of water hardness to cause boiler scale, priming, foaming, pitting or corrosion or caustic embrittlement.

There's no question about feed water conditioned by nature's own method discovered in the new TECHNICAL Water Conditioning System . . . a perfect balance of water's mineral content with correct, natural *organic substances.*

Technical

WATER CONDITIONING SYSTEM

TECHNICAL is a proven, natural system of individual formulas to fit each and every water type. It provides a special balance of water properties that definitely overcome scale, foaming, pitting, corrosion, priming, caustic embrittlement characteristic of boilers and condenser covering systems.

For your own satisfaction, investigate the new TECHNICAL System . . . Nature's own conditioning method developed under actual industrial operating conditions. Without obligation the coupon below will bring you the facts.

WATER TREATMENT COMPANY OF AMERICA

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☐ Please send the new Technical System bulletin.

☐ Haye a Water Treatment Company engineer call.

Name_____ Title_____

Company_____

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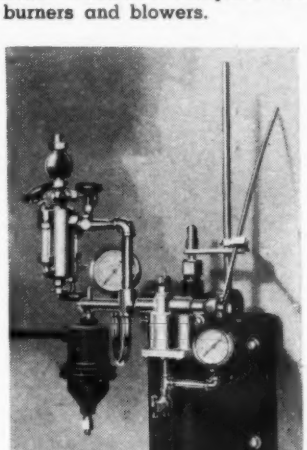
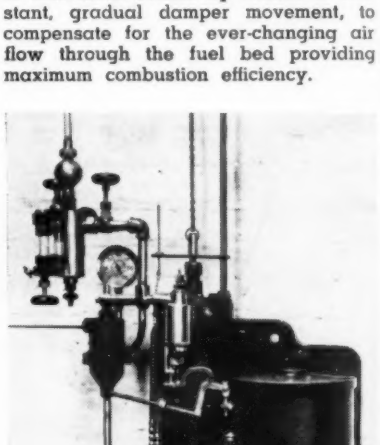
A-JACKS
Master Control

Operates constantly to maintain the required normal boiler pressure through balanced control of dampers, stokers, oil burners and blowers.



A-JACKS
Over-fire Control

Maintains the correct furnace pressure of individual boilers by means of constant, gradual damper movement, to compensate for the ever-changing air flow through the fuel bed providing maximum combustion efficiency.



A few of the many users

Van Camp Co.	California
Atlanta Coca Cola Bottling Co.	Georgia
Stevens Hotel	Illinois
Schenley Dist. Co.	Kentucky
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10 days delivery

Some territories open for representatives

A-JACKS

AUTOMATIC REGULATOR CO.

14 N. Clinton St. Chicago, Ill.

1. Tracer system enclosed with wire mesh foundation.

2. Asbestos insulating paper applied for heat protection.

3. First layer of hair insulating felt fastened in place.

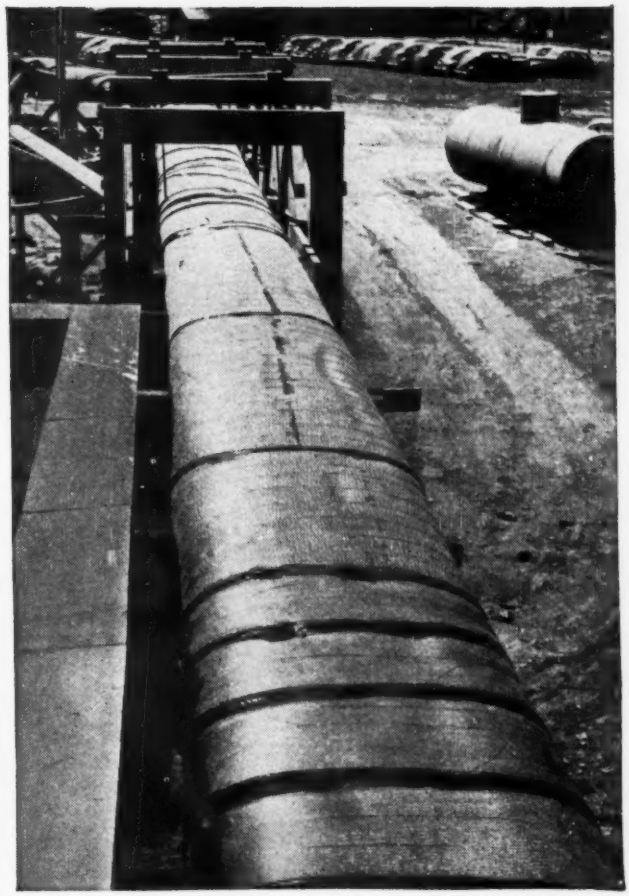
4. Water-resistant membrane applied to protect first layer of insulation.

5. Applying the second layer of hair insulating felt.

6. Second layer of water-resistant membrane covered by a heavy, weatherproof jacket.

WORKING TOGETHER! A good job of insulation, fast and at low cost—made possible by teaming the right Men and Materials with the most practical Methods of application. Installation by Achenbach & Butler, Inc., Ruberoid Approved Applicators at Philadelphia.

How Materials, Men and Methods Produced Tracer Line Efficiency



Picture Story

of insulating the Ruberoid way

• This job for the Beryllium Corporation is an unusual one. Important processing lines *had* to be held to a fixed temperature. The Ruberoid system of bringing the right insulation materials . . . men who know this field . . . and the correct method of application *together as one service* neatly solved the problem.

Ruberoid can offer this service because its completeness of line meets any problem up to 2100° F. Because Ruberoid has the Men – Approved Applicators – in every important industrial area . . . and because Ruberoid methods of application are grounded upon wide experience – with adequate research and engineering facilities for attacking *new* insulating problems.

The RUBEROID Co., 500 Fifth Ave., N. Y. 18, N. Y.

MATERIALS, MEN, METHODS—all 3 with

RU-BER-OID

THERMAL INSULATIONS

ADAMANT
FIRE BRICK CEMENT

Battles won't wait on Furnace Linings

Furnaces shut down for re-lining mean slowed-up production . . . so keep them in operation with longer-lasting-linings laid-up with Adamant. Its use means greater strength at the joints where breakdowns usually begin.

Tests Prove

Adamant has a bonding strength of 800 lbs. per sq. in. at room temperature; 1270 lbs. per sq. in. at 2600° F. These impartial tests were made by a leading technical institute. Adamant has a P.C.E. of more than 3000° F. For details . . . write

BOTFIELD
REFRACTORIES COMPANY

786 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES •

PRECISION-built? Sure they are! Correctly designed? Yes, sir! Constructed from finest, carefully selected materials? Every part! But, this is what really is important to you: Every Lonergan gauge indicates pressures accurately on a clear, easy-reading dial...and retains its high initial accuracy even under violent pulsations! That's why Lonergan gauges are standard in many plants.

J. E. LONERGAN CO.
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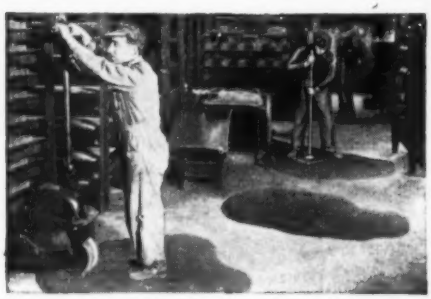
Lonergan

SIGN OF PROGRESSIVE ENGINEERING!

SINCE 1872

• SAFETY & RELIEF VALVES • PRESSURE & VACUUM GAUGES • SPECIALTIES •



PATCH FLOORS

. . . *While Traffic Rolls*

Roll a drum of INSTANT-USE over to the hole in the floor—remove the lid—shovel out enough to fill the hole—tamp smooth—and open the spot to regular traffic immediately, without waiting. You'll have a tough, solid, permanent patch that formerly took 24 hours to get. This rugged, new plastic bonds tight to old concrete, withstands extreme loads. Keep a drum on hand. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER

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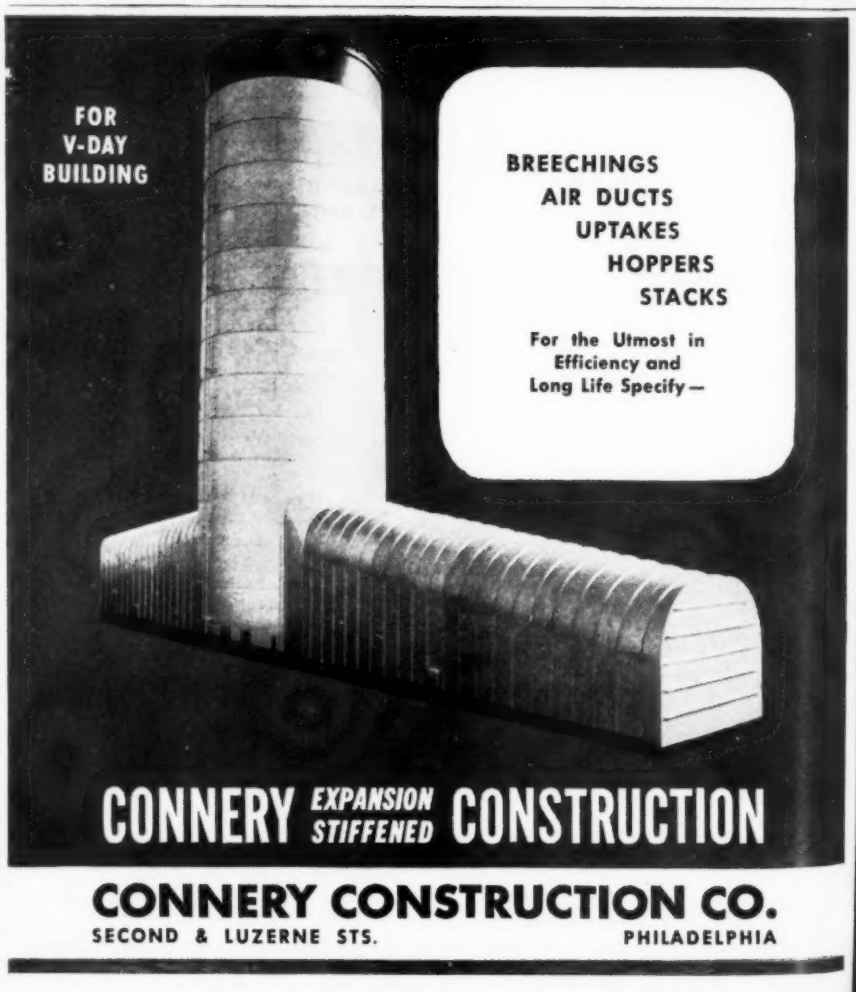
FREE TRIAL
OFFER

INSTANT-USE
FLEXROCK CO., 2377 Manning St., Phila., Pa.



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CONNERY CONSTRUCTION CO.
SECOND & LUZERNE STS. PHILADELPHIA

Look at Your Conveyor Problems

Through *Experienced Eyes*

In your industry, yours are the experienced eyes. We, at Stephens-Adamson, have the trained and experienced eyes in the material handling field.

Here are competent engineers (who have spent entire careers with this company)—ready always to help you gain an objective view of your conveying problems. For them, the highest goal is the installation of the right conveying system for any specific job . . . Here are men thoroughly qualified to go over your present or anticipated operations with one constructive aim — to discover faster, safer, low cost ways of moving materials. This is most significant when you start thinking—as we already are—about post-war conveying problems connected with new processes, new materials, new finished goods you may have in mind. Call in an S-A engineer to give you sturdy pegs on which to hang your thoughts.

STEPHENS-ADAMSON MFG. CO., 5 Ridgeway Ave., Aurora, Ill.

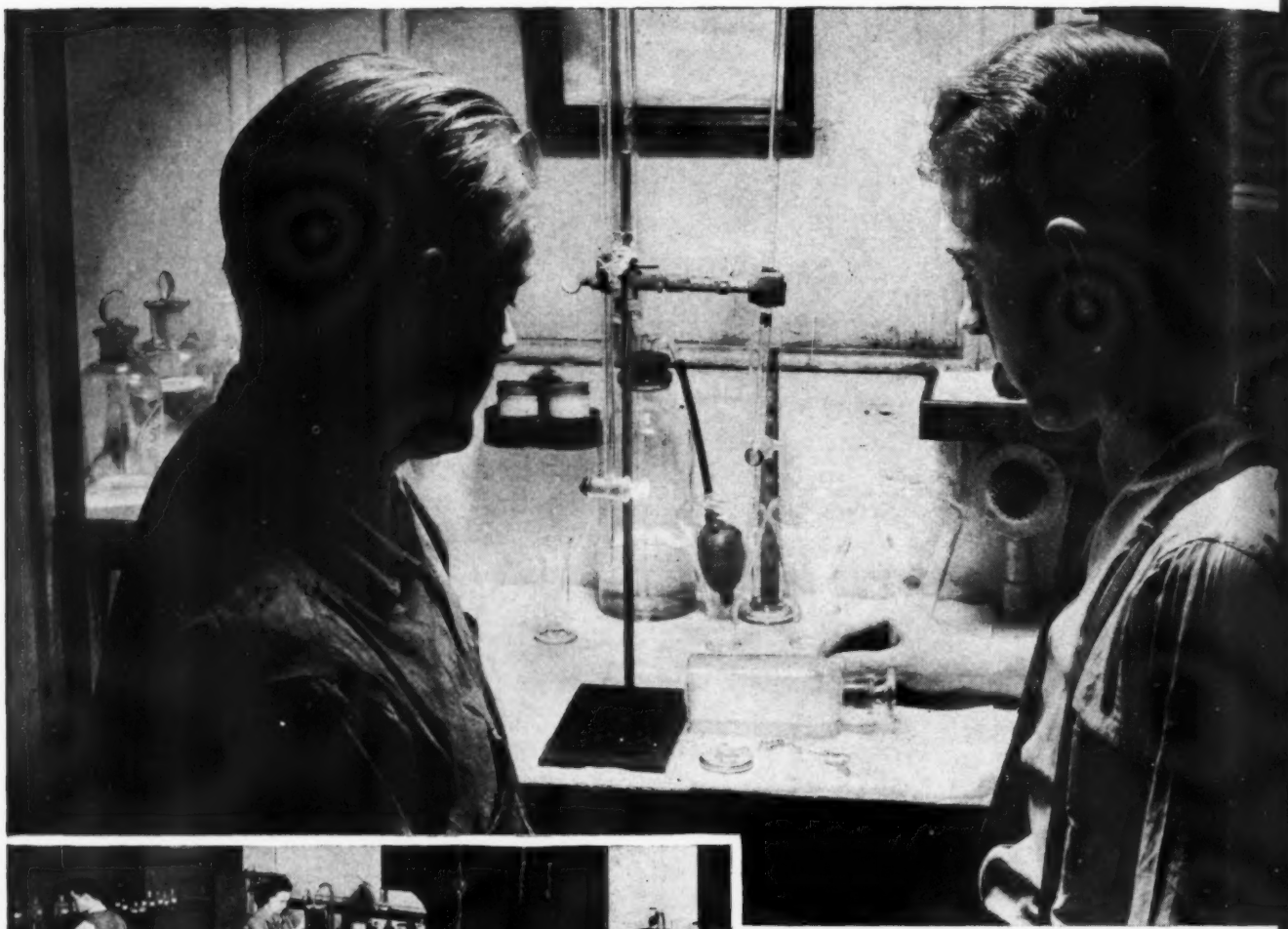
STEPHEN S-A DAMSON

MFG. CO.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

A BOILER WATER SERVICE



1. FIRST - HAND INFORMATION obtained by the Hall Field Service Engineer is the primary step in *preventive care* of boilers. The Hall Engineer instructs your power plant operator in how to make daily boiler water tests. These tests give Hall Laboratories intimate knowledge of what's going on in your boilers.

2. PREVENTIVE CARE IN ACTION. Hall Laboratories' careful periodic analysis of boiler water from your plant, coupled with simplified control analyses by the plant personnel, assure proper boiler water conditions to keep your plant in steady operation year after year.

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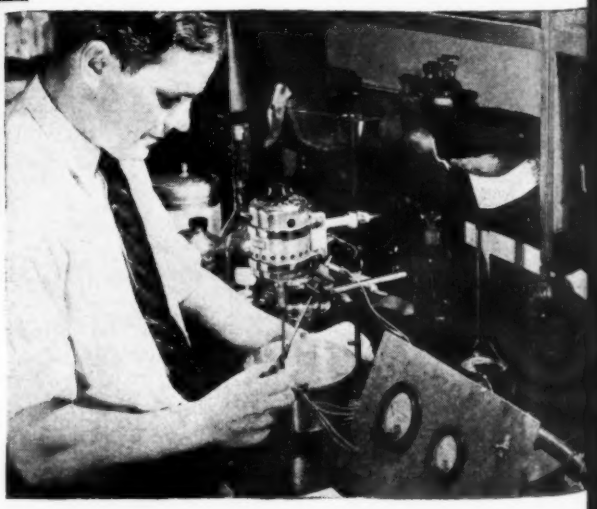
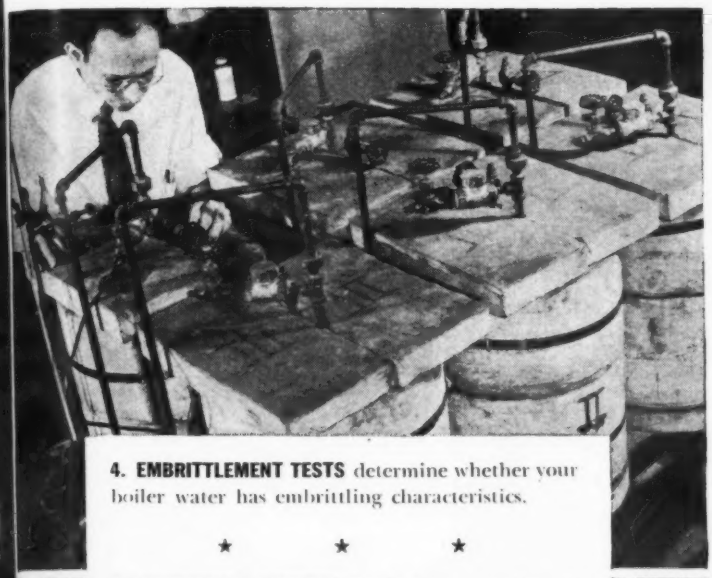


3. SOLVING THE TOUGH PROBLEMS. Metallurgical analysis of a split boiler tube is indispensable in determining the underlying cause of the trouble.

not MEASURED IN SALES



4. EMBRITTLEMENT TESTS determine whether your boiler water has embrittling characteristics.

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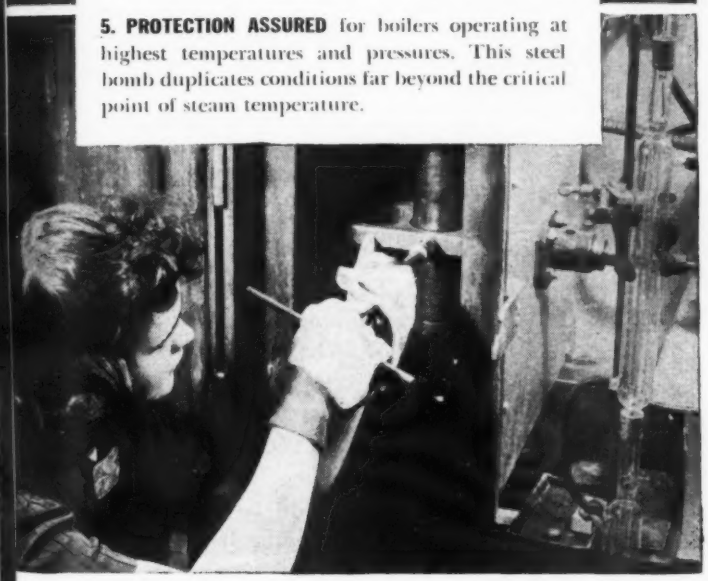
5. PROTECTION ASSURED for boilers operating at highest temperatures and pressures. This steel bomb duplicates conditions far beyond the critical point of steam temperature.



Why Hall Field Engineers are *salaried* specialists

THE Hall engineer assigned to you has only one aim—to help you keep your boilers in prime condition. An unscheduled outage caused by water in his territory is one of the worst things that can happen to him—because he is paid to help prevent it from happening. The Hall engineer uses all of the tools of his trade, but he derives no commissions from any chemical or equipment he prescribes.

It takes years to make a Hall Field Engineer . . . years going to school to the men who pioneered in boiler water conditioning and who are today's acknowledged leaders in this field.

The need is plain. A Hall Field Engineer shares the responsibility for millions of dollars worth of critical equipment. He can't carry on that job the way we mean he should if he has any commercial interest. His own success, and that of the Laboratories, rests solely upon his ably answering the challenge.

Unique? Perhaps. But to ourselves and to the hundreds of important plants we have served for years, it makes pretty good sense. May we tell you more about it?

HALL LABORATORIES, INC.

A subsidiary of Hagan Corporation

HAGAN BUILDING, PITTSBURGH, PA.

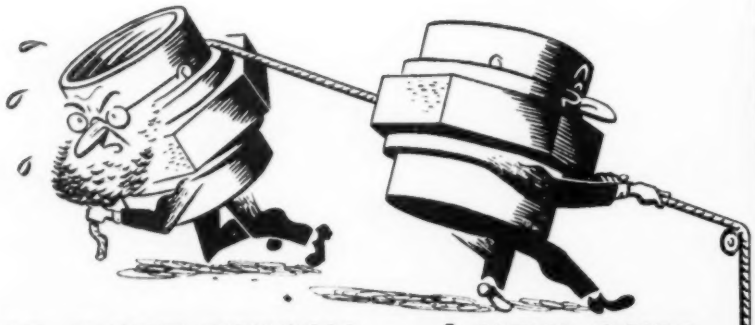
Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

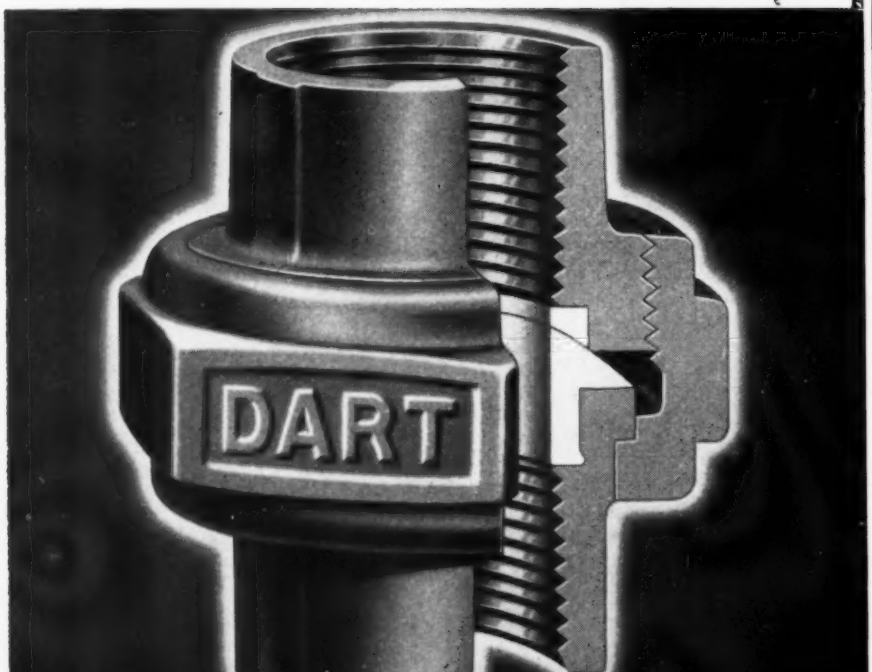
HALL SYSTEM of Boiler Water Conditioning

HAGAN
HALL
BUROMIN
CALGON



OLD DART UNIONS and NEW ONES

PULL TOGETHER FOR VICTORY



...Put Your USED DARTS Back to Work

Old Dart Unions can *pull their weight* along-side *new* ones in the tug-of-war *production*. For, even though a Dart Union has been used over and over again, it is still capable of going back to work and giving dependable, *tight-joint* performance.

There are good solid reasons why Dart Unions can offer such extra dividends in long life and trouble-free performance. Here is one reason: Dart's matched bronze inserted seats are precision machined and ground to an accurate true-ball joint. *And:* Dart bodies and nuts are extra heavy, made of air-refined malleable iron that resists corrosion, pipe strains and wrench abuse.

So, locate your old Dart Unions and let them *pull together* with the new Darts you get from your supplier.

DART UNIONS

The "HOWS" and "WHYS" of GASKET ENGINEERING

...from the Research Laboratory of "Gasket Headquarters"

Do you know all the factors bearing upon the selection of the proper gasket for a particular service?

Enlightening information is contained in the current issue of "The Gasket"—the first of a series of technical bulletins to be issued by the modern Research Laboratory of the Goetze Gasket and Packing Company, oldest and largest manufacturers of industrial gaskets in America.

We will be glad to send these bulletins to you regularly, if you write on company letterhead, giving your position.

GOETZE GASKET & PACKING, CO., Inc.
10 Allen Avenue, New Brunswick, N. J.

Goetze for GASKETS

CANTON STOKER INSTALLATIONS ARE *Double* CONTRIBUTIONS TOWARD VICTORY . . . . .

HUNDREDS OF "FAMOUS NAME" PLANTS RELY ON CANTON STOKERS . . . .

Bell Aircraft Corp., Republic Steel Corp., General Motors Corp., and Black & Decker, are just a few of the many prominent organizations who after careful analysis chose CANTONS — numerous repeat orders throughout this list indicate the high degree of satisfaction.

54 STOKER TYPES AND SIZES TO MEET VARYING STRUCTURAL CONDITIONS AND COAL BURNING NEEDS

• Because conversions quite frequently present problems of space and vital time loss, numerous CANTON installations were the result of the ability to successfully meet unusual requirements. With both Wormfeed and Ramfeed Stokers engineered for applications up to 800 H.P. and more, CANTON offers a most complete line. The illustrations above are of CANTON Lo-Set Ramfeeds with Uniflex drives; advantages include rapid time-saving installation, all operations in the front, shallow floor level ashpits, and front motor mountings—ideal for limited space. High overload capacities and low maintenance and steam costs can always be counted on from CANTONS. May we send you all the facts today? Use the coupon now.

Canton Uniflex Ramfeed Stoker

★ ★ ★

ALL "CANTONS" GUARANTEED 5 YEARS AGAINST DEFECTS AND WEAR AS WELL

CANTON STOKER

• Exclusive with CANTON is this 5 year Bond—only CANTONS' rugged and durable construction could make possible this guarantee against DEFECTS and WEAR as well.

32 YEARS OF "KNOW HOW"

CANTON STOKER CORPORATION

741 Andrew Place, S. W., Canton, Ohio

Gentlemen:

.....Please send all descriptive literature at once.

.....Have a CANTON Engineer interview us immediately

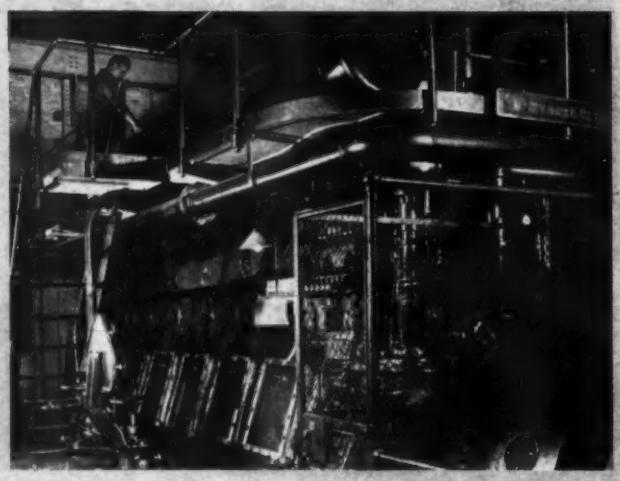
Name .....

Company .....

Address .....

City .....*State* .....

Because of its greater stability —



Gulf Parvis Oil

insures long Diesel life and operating economy

"OUR two oldest Diesels have operated efficiently for twenty years with Gulf Parvis Oil in service," says a municipal power plant Superintendent. "During this period only one repair has been necessary—a liner change. These engines still run sixteen hours a day and deliver their full share of plant output."

Here's the important reason for the fine service records of Diesels lubricated with Gulf Parvis Oil: This higher quality oil *retains its lubricating value longer*—it stands up and provides a tough protective film that keeps moving parts properly lubricated.

Because of its greater stability and the extra margin of protection it affords, Gulf Parvis Oi insures minimum wear, minimum down time and efficient, dependable Diesel performanc under today's peak-load and overload operat ing conditions.

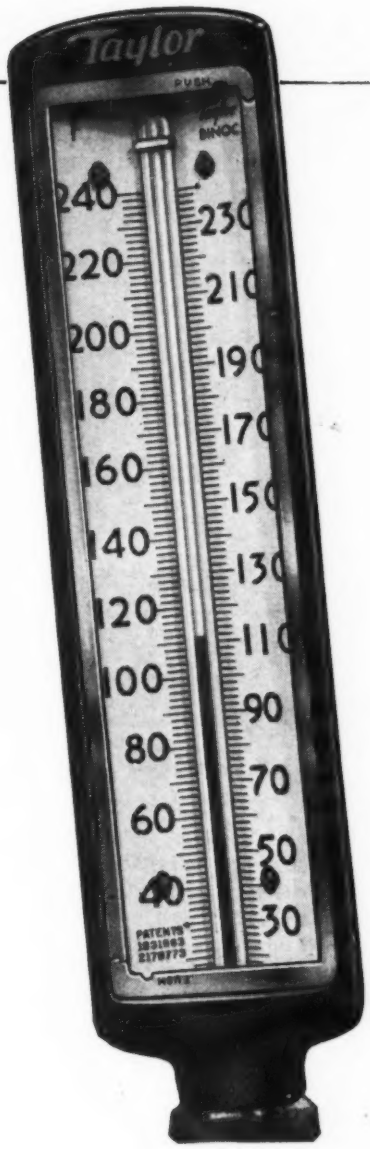
For effective help in *your* fight against wear take this step today: Call in a Gulf Lubricatio Service Engineer and ask him to recommend th proper grade of Gulf Parvis Oil to fit you particular requirements. His thorough training and broad practical experience with all types o Diesel engines are your assurance of sound lubri cation recommendations. Write, wire, or phon your nearest Gulf office.

GULF OIL CORPORATION · GULF REFINING COMPANY

GULF BUILDING · PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

Why is a thermometer like a book?



Because it's no good unless you read it!

There's not much point in having industrial thermometers that are hard to read, because human nature being what it is, *they don't get read!*

That's why you'll like this new improved Taylor Industrial Thermometer. It actually *invites* frequent reading, because the new one piece case is shallower and the triple-lens BINOC tubing stands out even more vividly, with a wider range of vision than before.

What's more, it's *vibration-proof!* No separate front to rattle or work loose. A two-piece interlocking bezel holds the thick glass window against four tension springs fastened with shake-proof screws. It's *practically dustproof* too because of this same tight-fitting construction.

And when you add *permanent Taylor accuracy*—the result of artificial ageing to prevent loss of accuracy when in use—the result is a really superior article! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.*

ARMY E NAVY

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

KEEP ON BUYING U. S. WAR BONDS AND STAMPS ★

More than a "Separator"

PROTECTOMOTOR PIPE LINE FILTER DELIVERS *Clean* AS WELL AS *Dry* AIR

Rust, Pipe Scale, Dirt and Dust removed in addition to Water and Oil

Repeat orders from hundreds of leading American concerns prove that Protectomotor Pipe Line Filters save money, speed production. Easy and quick to install. Protectomotors have often saved their entire cost in a single month.

Find out how in your operation Protectomotors will increase output, help win the war.

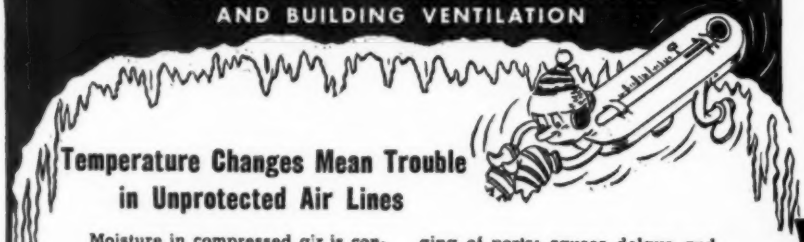
WRITE FOR CATALOG; also Data Form for Free Analysis of your requirements.

STAYNEW FILTER CORP.

23 CENTRE PK. ROCHESTER, NEW YORK

Air Filter Headquarters

FILTERS FOR PIPE LINE, ENGINE INTAKE AND BUILDING VENTILATION



Temperature Changes Mean Trouble in Unprotected Air Lines

Moisture in compressed air is condensed as the air passes through cold sections of pipe. Unless removed, this water washes out lubrication from air-powered tools, freezes upon expansion in these tools, and causes loss of power or stoppage due to clogging of ports; causes delays and waste at other points of compressed air usage. Staynew Pipe Line Filters (Protectomotors), installed as near point of use as possible, remove condensed water and prevent these troubles.

Model CPH

Positive Action ★ Exclusive Construction

As air strikes Aluminum Baffle (2) most water, oil and heavier particles are thrown to sides of Container (1), draining to bottom where excess is drawn off thru Drain Cock (5). Passage of all wet or dry matter is positively prevented by exclusive Feltex dry-type filtering medium in patented Radial Fin Insert (4). Only clean, dry air is delivered.

PROTECTOMOTOR AIR FILTERS

YOU NEED PROTECTOMOTOR MORE THAN EVER IN WINTER

"KNOW HOW!

TO GET THE MOST OUT OF YOUR *Packings*"

With materials shortages, the Packing Industry faces a difficult task—to supply Industry with packings so vital in our War Effort. Naturally this is being done, but not without difficulties promoted by present conditions.

Under these circumstances, knowing how to get the most out of your packings takes on new importance. Through proper packing, conserved wisely, machines can be kept running efficiently at less cost. 'Know How' simplifies packing difficulties; points the ways and means to conserve vital packings; and, reduces packings problems to a minimum.

To help you get the most out of your packings, Belmont Packings, as a service to you, suggest below ways to make your packings last longer:—

1. CONSERVE PACKINGS—When repacking, it may be found that a few rings of new packing inserted next to the gland may give added service. This will mean conservation of old packing retained in the stuffing box.

2. LUBRICATE MOVING PARTS—Keep rods, shafts and plungers thoroughly swabbed with oil or grease to alleviate frictional wear on packing. Where practicable, install oil lanterns.

3. CHOOSE SUBSTITUTE CONSTRUCTIONS—When material shortages make your desired type not instantly available, consult with your nearest Belmont distributor or with us for guidance on this question.

4. REFER TO THE BELMONT CATALOG—It's an invaluable packing guide of complete information on packings for all services... it contains informative charts; clearly illustrates and describes every Belmont packing; and suggests varied packing styles from which to choose a substitute packing, if necessary. Write on your Company letterhead for your copy.

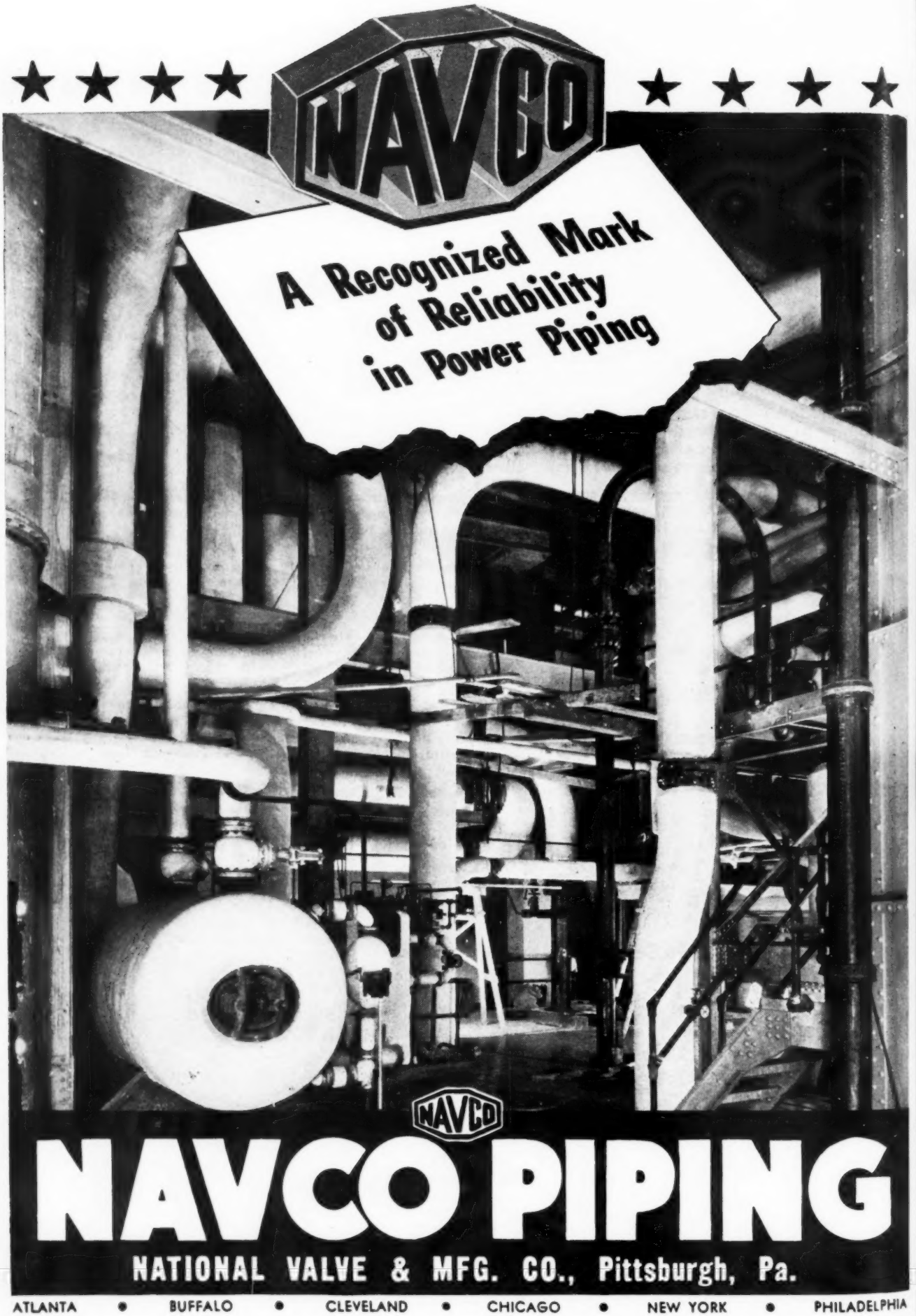
BELMONT PACKINGS

The Belmont Packing & Rubber Co.

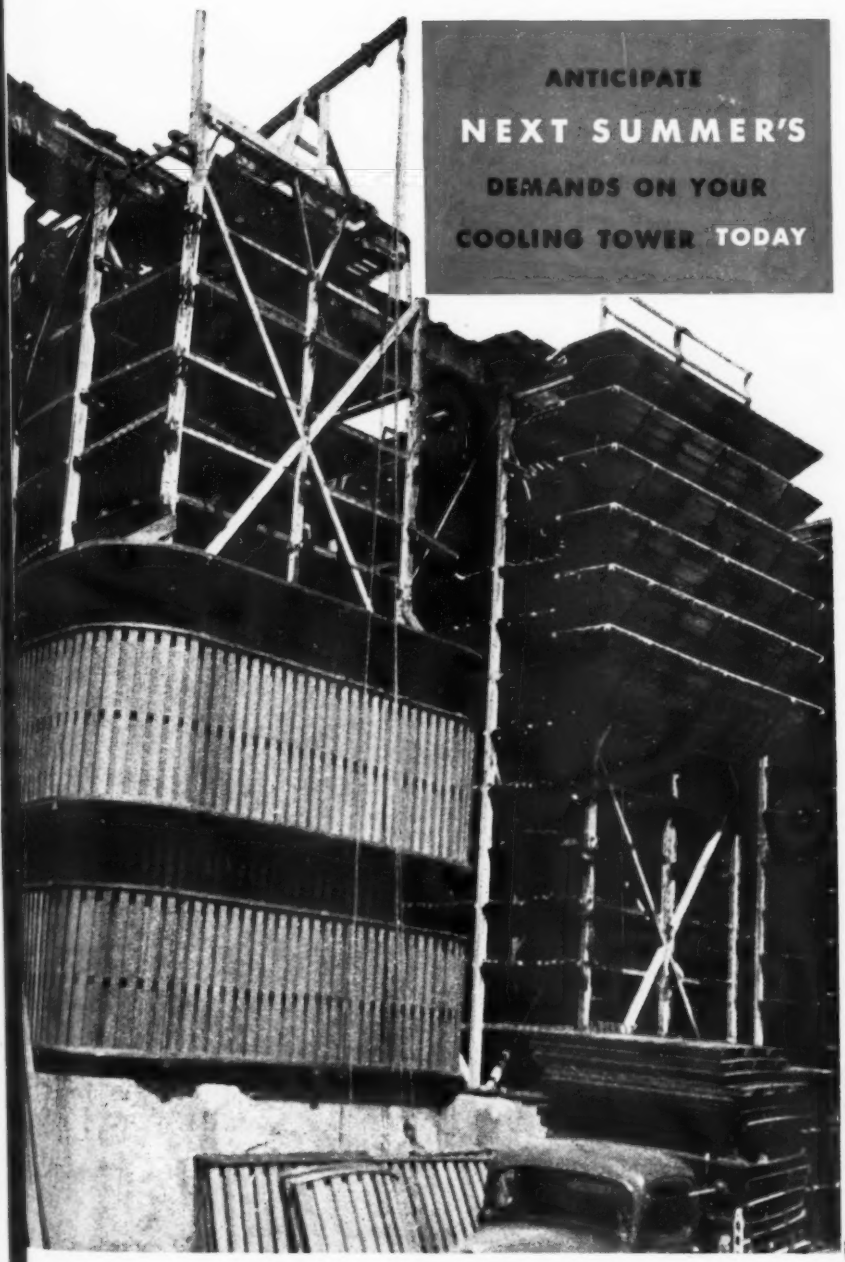
Butler and Sepviva Sts., Philadelphia 37, Pa.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

There's a Belmont Packing for every service... Steam, Water, Oil, Gas, Air, Acid, Alkalis, and Ammonia. Forms include Rings, Coils, Spirals, Reels, Spools, Sheets, and Gaskets.


NAVCO
A Recognized Mark of Reliability in Power Piping
NAVCO
NAVCO PIPING
NATIONAL VALVE & MFG. CO., Pittsburgh, Pa.
ATLANTA • BUFFALO • CLEVELAND • CHICAGO • NEW YORK • PHILADELPHIA

Put FLUOR MAINTENANCE AND REPAIR *Service on Your Schedule* NOW *While Materials and Labor are Still Available*



YOUR OPERATING RECORDS will show you what your water cooling requirements have been *this past summer. You can estimate now* what they will be *next summer.* To be sure that your tower, regardless of make or type*, can meet these anticipated demands you should have Fluor check these seven vital *maintenance* and *repair* needs now: (1) Condition of decks or filling (2) Condition of flumes or distributing system (3) Analysis of water loading (over-loading or under-loading) (4) Analysis of net effect of re-cycling (5) Condition of stair treads, ladder rungs and hand rails (6) General condition of structure (7) Condition of mechanical equipment (motors, fans, gears, flexible couplings, etc.).

Deficiencies at any one or all of these points will be corrected by Fluor *maintenance* and *repair* service. The result is increased operating and thermal efficiencies and longer life for your cooling tower.

The coming winter months lessen the demands on your cooling tower. So put Fluor *maintenance* and *repair* service on your schedule now, while materials and labor are still available. Call, write or wire your nearest Fluor office today for immediate action.

SINCE 1890

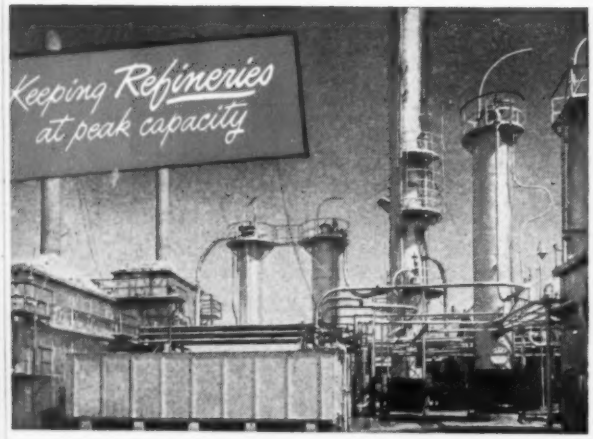
* Fluor *maintenance* and *repair* service covers *all makes and types of cooling towers.* Fluor also manufactures Atmospheric and Mechanical Draft Type Cooling Towers for the cooling of process water — in any quantity, in all services.

FLUOR

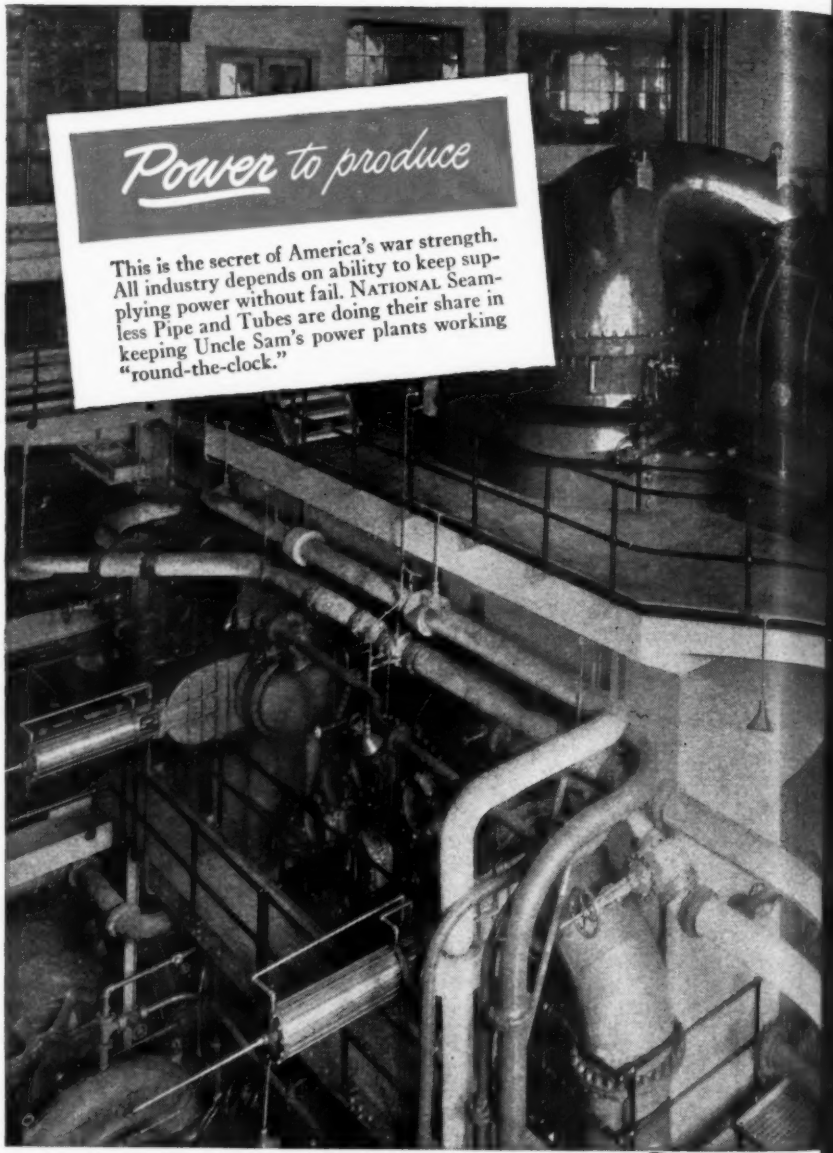
COOLING TOWER DIVISION OF THE FLUOR CORPORATION LTD.

2500 So. Atlantic Boulevard, Los Angeles 22, Calif. • New York • Pittsburgh • Kansas City • Houston

PIPE helps American Industry



That's a job for NATIONAL Seamless Alloy Tubes—they are serving in many of America's leading gasoline refineries and synthetic rubber processing plants.


Power to produce
This is the secret of America's war strength. All industry depends on ability to keep supplying power without fail. NATIONAL Seamless Pipe and Tubes are doing their share in keeping Uncle Sam's power plants working "round-the-clock."

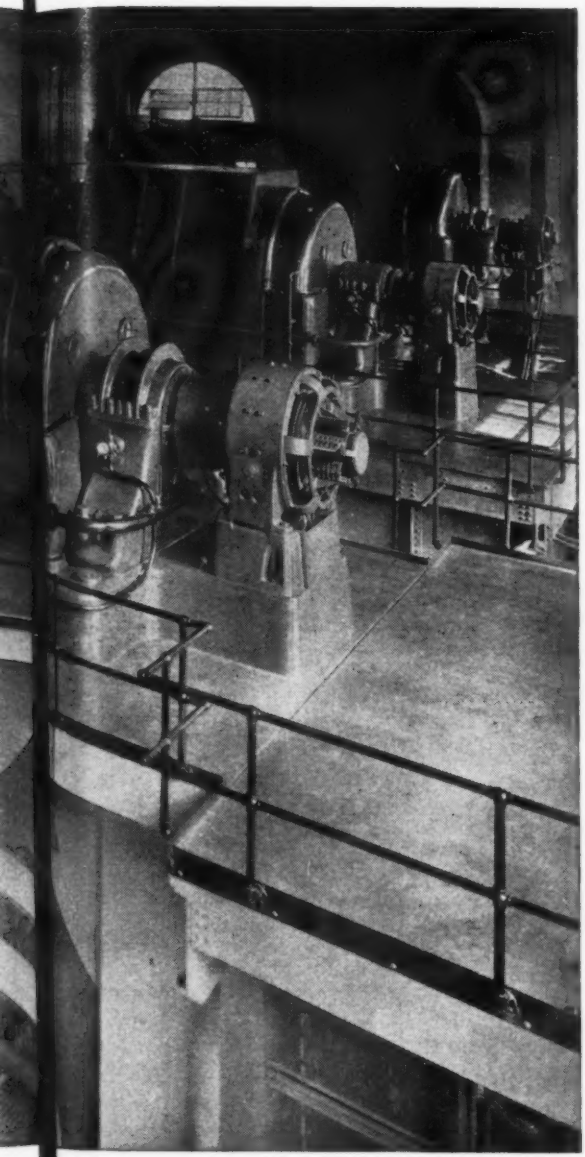
They move the heavy stuff on fast schedules. Locomotives like this "Big Boy" are kept on the job by NATIONAL Seamless Boiler Tubes which have shown extremely long life in service.

Plants of NATIONAL Tube Company have broken records again and again in meeting bigger production schedules for seamless airplane tubing.

Designed to deliver 300,000 barrels of crude oil a day to the east coast, "Big Inch" pipeline has now been completed and oil is flowing to help rel the shortage. The main line used 1,110 miles of 24-inch National Seamless P

UNITE

achieve production miracles



IN one short year, America transformed peace plants to war plants and achieved literally impossible goals of production. The figures for that year were so high that Germany, Italy and Japan scoffed at them as wild dreams. 60,000 planes, 8 million tons of shipping, 45,000 tanks did look like astronomical figures. But at the year's end, most of these goals were well within sight—some even exceeded. This year, at the present rate of production, they will be far surpassed—in some cases more than doubled.

Back of these production miracles is a story of men and machines working as they never worked before —a story of equipment pushed to the limit of its capacity with mighty little time out—and, basic to all industry, a story of power generated, controlled, and delivered by *pipe*.

As America's largest producer of seamless pipe and tubing, NATIONAL Tube Company's plants are delivering more tonnage than ever before in history. This is going into the all important program for more ships, more planes, more tanks, and hundreds of other war uses.

Every day our specialists are helping to work out solutions that keep plants operating longer, that make products lighter and stronger, that save thousands of pounds of steel. If you have a pipe problem in connection with war work, our experience is placed at your disposal without obligation.

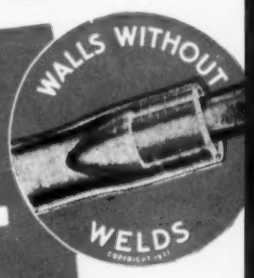
NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

...y get their power from boilers—each containing hun-...ds of seamless steel boiler tubes. NATIONAL plants have ...t the supply flowing to meet huge increases in demand.

NATIONAL SEAMLESS



...S T A T E S S T E E L

THE BREATH OF LIFE—

SUPPLIED BY

CLARAGE

TESTING FANS FOR NAVY SERVICE

Clarage fan wheels are statically and dynamically balanced to eliminate vibration as far as humanly possible. Precision methods are employed, using the most sensitive testing machines obtainable. By conquering wheel vibration, the shaft and bearings of Clarage fans are protected against excessive wear — and noisy operation. Then, after assembly, complete fan units are power tested, making certain all parts are functioning properly.

One of our Important War-time Assignments is the Building of Ventilating Fans for Thousands of Fighting and Merchant Ships

Down in the hold of a modern ship — freighter or battle wagon — *men can't live without mechanical ventilation.*

★ The Clarage marine type fans which supply the vital fresh air are engineered and built for this one job. They are all steel — no cast iron. Cast iron is out because it shatters and acts like shrapnel when hit by gunfire or torpedo — the flying pieces endangering lives. Steel also means less weight, and that's important on shipboard.

★ Compactness is another desired feature. Clarage gets this by streamlining the fan housing and by mounting the fan wheel directly on the motor shaft — space saved from 20 to 35%.

★ But building marine type fans is only one of many air-handling problems, created by war, which Clarage is today successfully handling. *Perhaps our biggest job is helping industry speed vital production.*

★ If you need any type of air-handling equipment for use in connection with war work, *call in the nearest Clarage application engineer.* You will find our engineering facilities adequate to give you the kind of service you should and must have.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

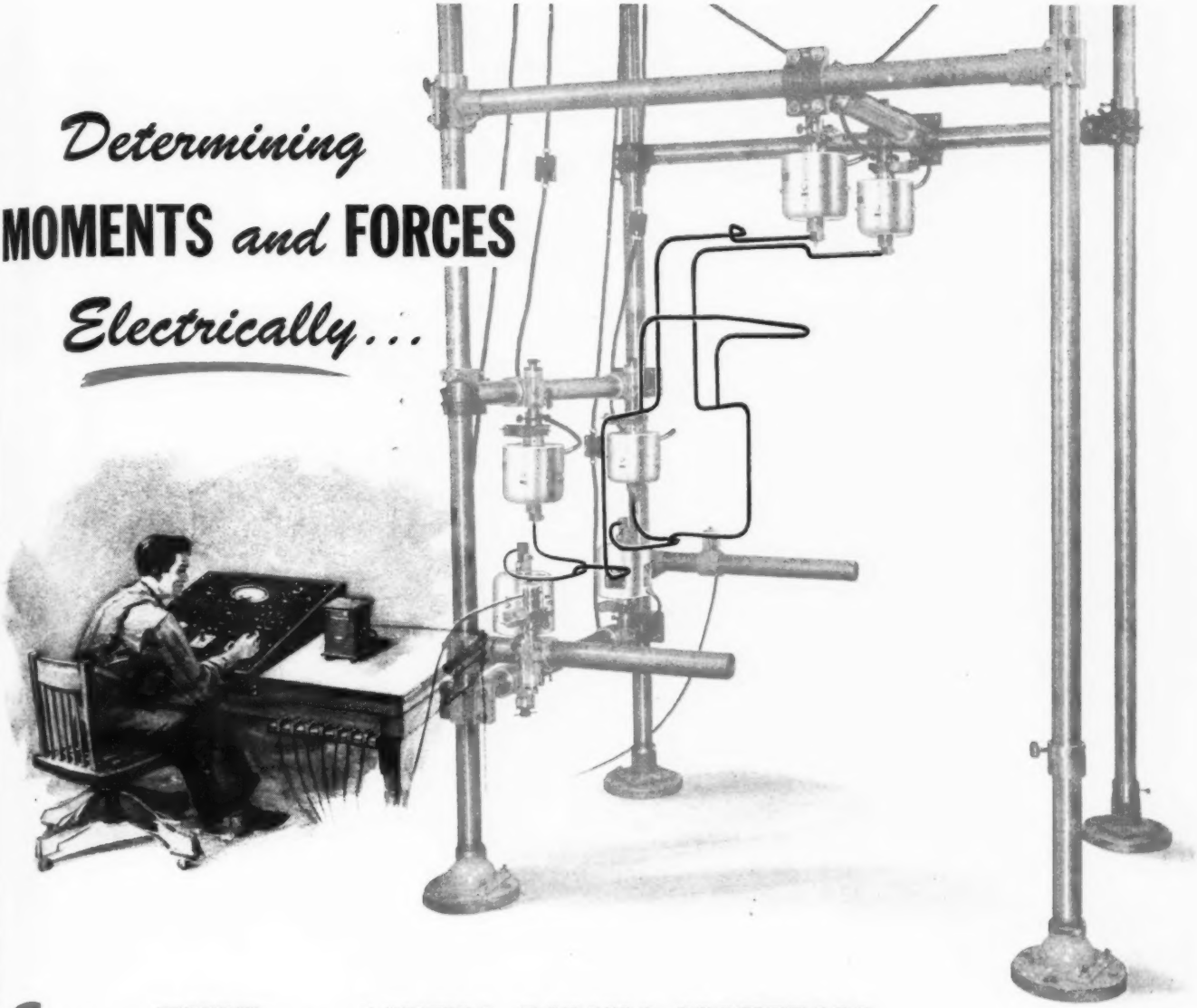
Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Determining

MOMENTS *and* FORCES

Electrically . . .



Saves **TIME *and* VITAL PIPING MATERIAL**

The most complicated design problems of high temperature piping systems are solved by apparatus perfected and used by The M. W. Kellogg Company.

Through tests conducted on models built to scale, an exact scientific analysis of the end reactions is determined. Stresses are then computed from these reactions. The apparatus used determines the forces and moments electrically, giving faster readings and eliminating the variations present in mechanical weighing due to friction and sticking in the apparatus. Forces are weighed down to one-hundredth of a pound.

When designing complicated piping systems, the use of this scientific method secures exact results, saves time and often substantially reduces the quantity of vital piping material required.

KELLOGG

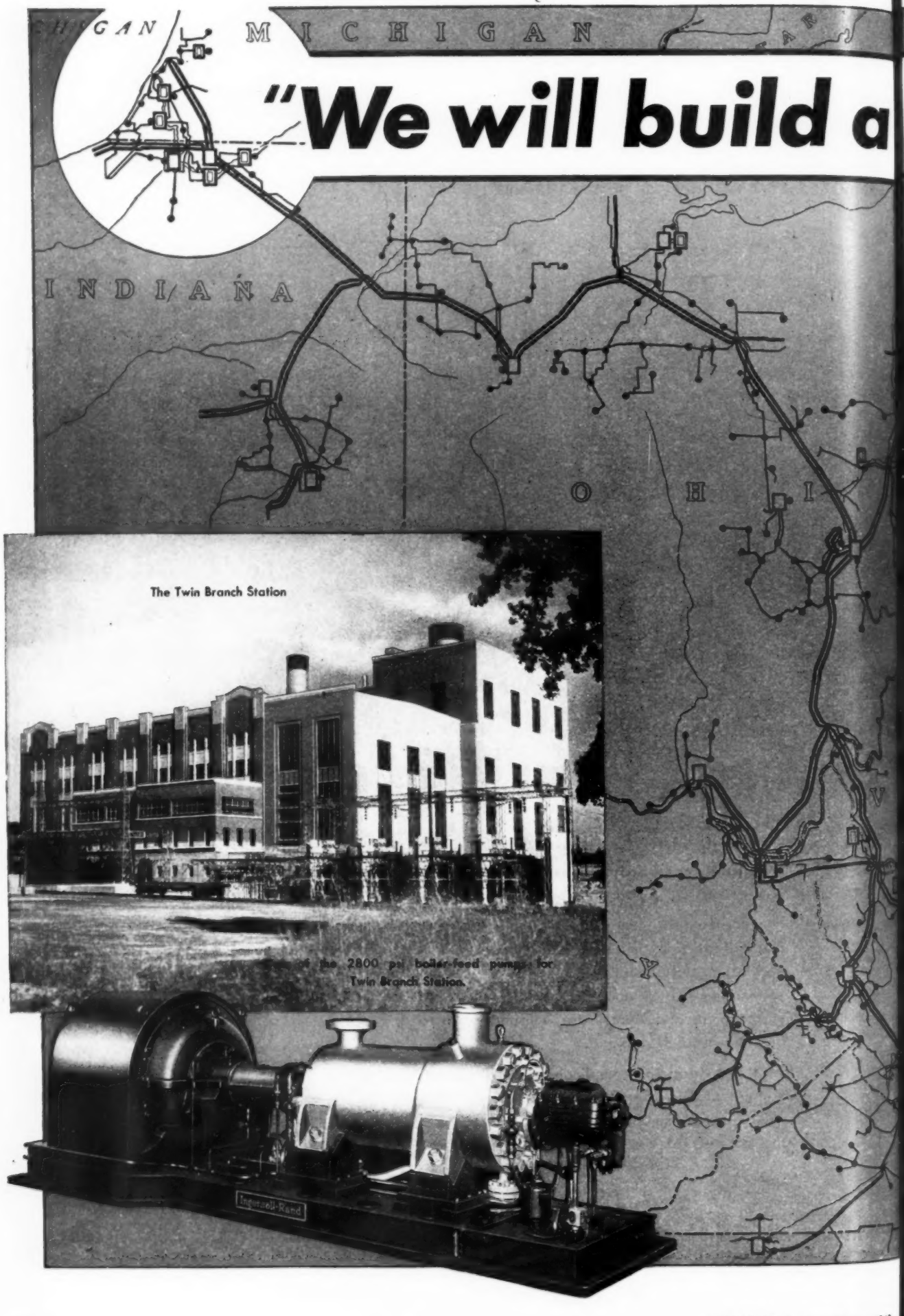
THE M. W. KELLOGG COMPANY

JERSEY CITY, N. J. • 225 BROADWAY, NEW YORK 7, N. Y.

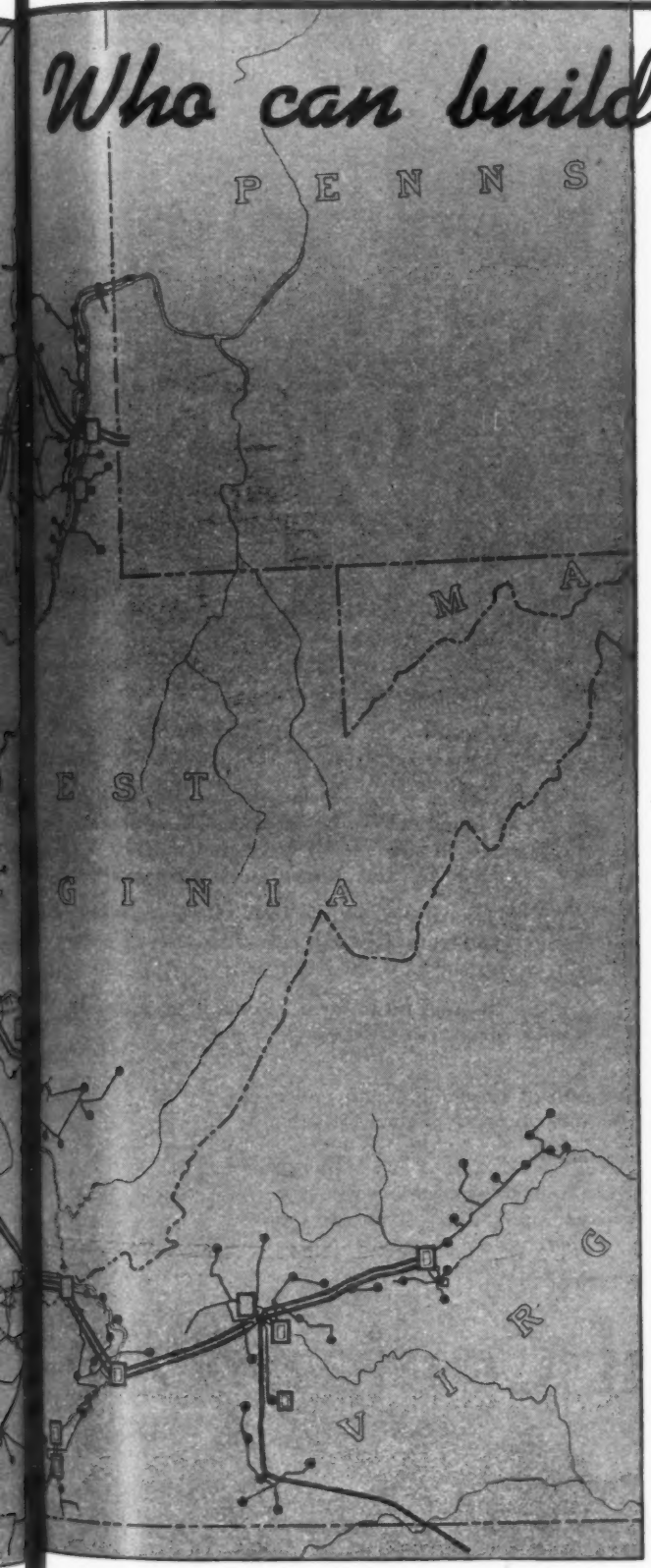
Representatives:

LOS ANGELES: 609 SOUTH GRAND TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants • Plastic Refractories. Radial Brick Chimneys


MICHIGAN
"We will build a
INDIANA
OHIO
The Twin Branch Station
Twin Branch Station.
Ingersoll-Rand

2500 lb. station here"



Who can build the boiler-feed PUMPS?

When the American Gas and Electric Service Corporation planned a 76,500 kw high-pressure addition to the Twin Branch Station, no one had ever built boiler-feed pumps of this size for 2800 lb. per sq. in. pressure.

For years Ingersoll-Rand has been a leader in the manufacture of high-pressure boiler-feed pumps and had furnished pumps for every steam station in American Gas and Electric's Central System. So it was natural that Ingersoll-Rand should be asked to help solve the pump problem at Twin Branch.

Three 8-stage, boiler-feed pumps were supplied. Each has a capacity of 1230 gpm, a discharge pressure of 2800 psi, a suction pressure of 700 psi and handle boiler-feed water at 340°F. Each pump is driven by a 2500 hp, 3600 rpm motor.

Two primary boiler-feed or tank pumps were also supplied. These have a capacity of 1275 gpm, a discharge pressure of 700 psi, a suction pressure of 50 ft. and handle 262°F. water.

The 700 psi suction pressure of the boiler-feed pumps was selected so that the boiler-feed units from an existing section of the plant could be used as spare tank pumps. The new boiler-feed pumps have forged-steel, barrel-type casings. They were specially built for Twin Branch Station but the fundamental I-R design had been proven in other boiler-feed plants and in the refining industry.

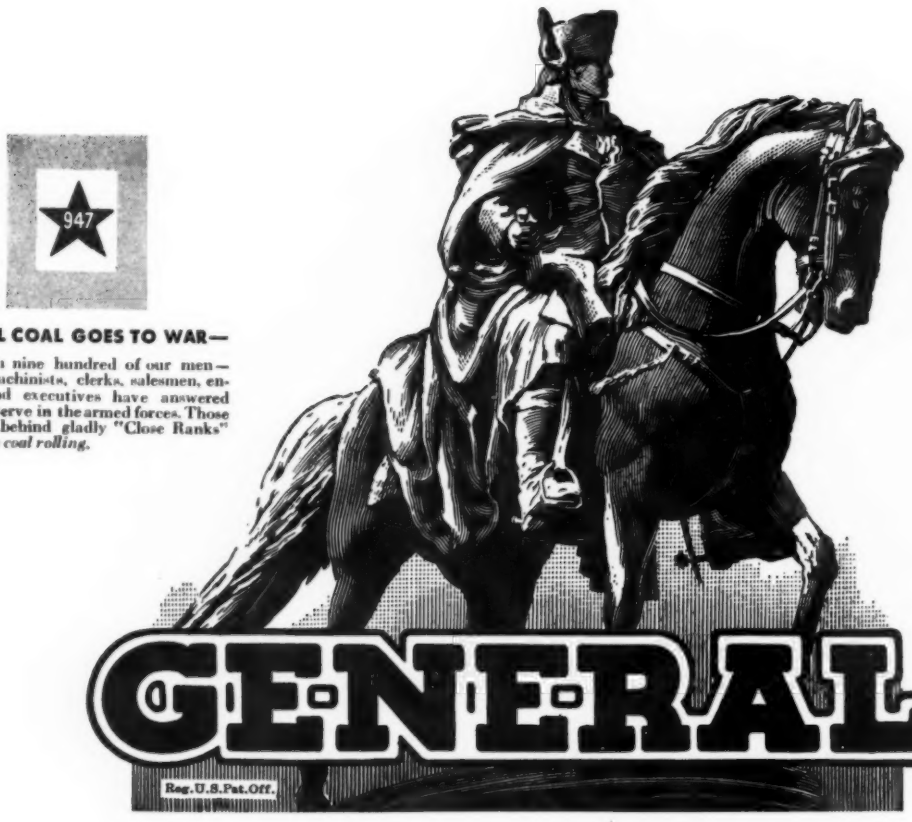
Twin Branch Station has now been successfully operating for two years. Result: More power to beat the Axis.

Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York, N. Y.

Ingersoll-Rand

10-316

CENTRIFUGAL PUMPS • CONDENSERS • COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • OIL AND GAS ENGINES



GENERAL COAL GOES TO WAR—

More than nine hundred of our men—miners, machinists, clerks, salesmen, engineers and executives have answered the call to serve in the armed forces. Those of us left behind gladly "Close Ranks" to *keep the coal rolling.*

RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE — Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiral Coal — Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

GENCO — Steam and domestic coals from a number of producing districts.

ANTHRACITE — Premium and standard qualities in the entire range of Anthracite burning characteristics.

Capable engineering personnel and the experience gained through long and varied marketing activity assures proper application of one of the above brands and effective servicing of any fuel requirement.

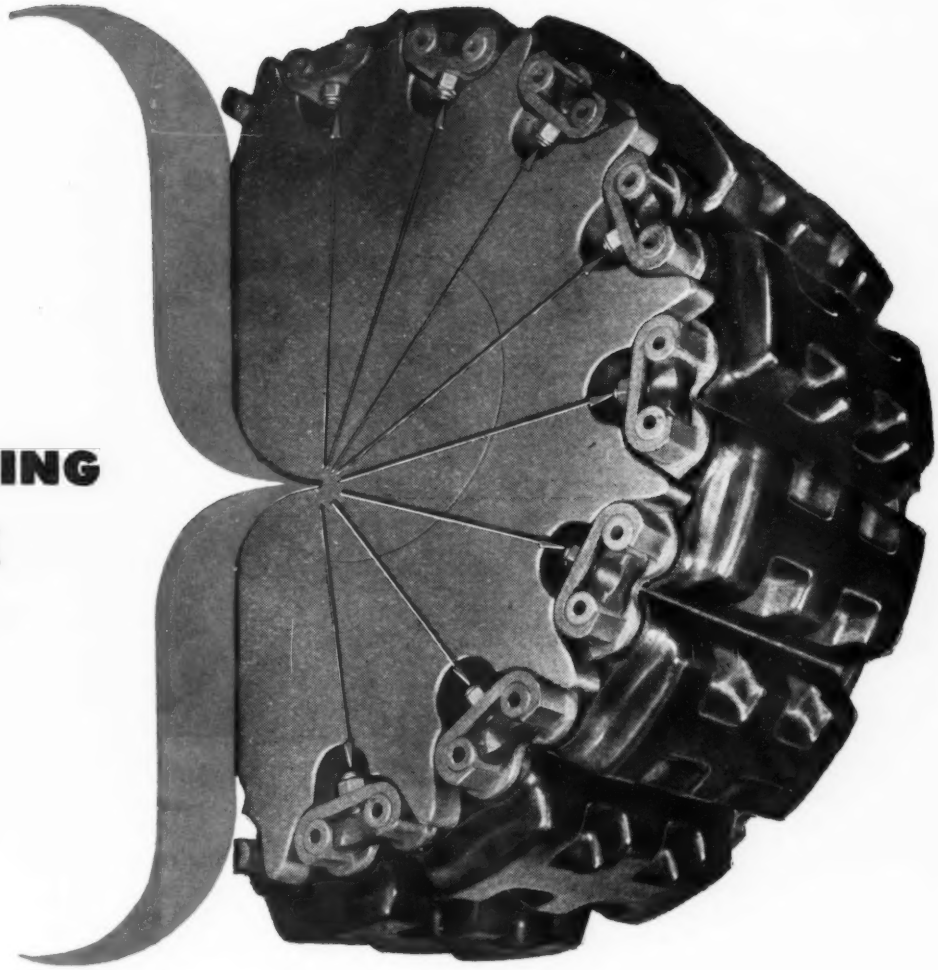
General Coal Company

123 SOUTH BROAD STREET — **PHILADELPHIA, PA.**

Branches

BLUEFIELD, W. Va.
BOSTON
BUFFALO
CHARLESTON
CHARLOTTE, N. C.
CINCINNATI
DETROIT
NEW YORK
NORFOLK
PITTSBURGH

HARNESSING THE KICK OF 1000 HORSES



• Here's the drive cog of a tank.

It tugs that tread with a yank that has as much as a thousand horsepower back of it.

And Elastic Stop Nuts—a single one on each lug—hold that tread.

This is just one of the war-fastening jobs Elastic Stop Nuts are doing. There are more of them on America's planes, tanks, guns, naval vessels and production equipment than all other lock nuts combined.

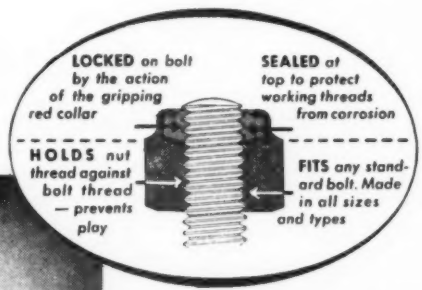
You know why.

It's because of the red elastic collar which makes these nuts lock fast and stay put in the face of vibration—anywhere on the bolt.

This collar molds itself tightly to the bolt. It keeps the nut and bolt threads in pressure contact. The nut can't wiggle or turn.

Later on, these nuts will be available to do this kind of job for industry. Products will be better, stronger, longer-lasting. Production routine will be free of frequent "take-ups," inspections and replacements.

If your postwar planning includes a fastening problem, let us know. Our engineers will gladly suggest a way to solve it and recommend the appropriate Elastic Stop Nut.


LOCKED on bolt by the action of the gripping red collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents play
FITS any standard bolt. Made in all sizes and types

ELASTIC STOP NUTS

Lock fast to make things last

ESNA TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY AND LINCOLN, NEBRASKA

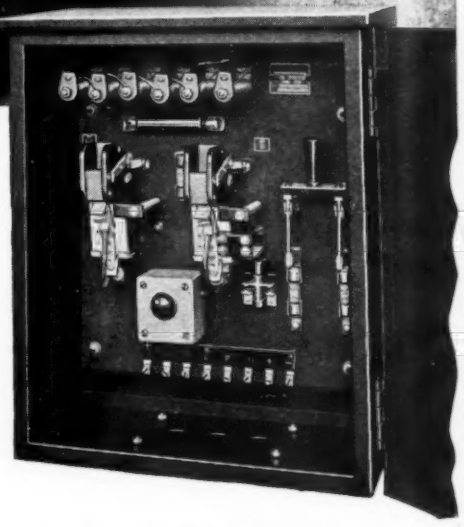
EC&M Spring-Loaded Magnetic Contactors "met the situation"

Official U. S. Navy photograph

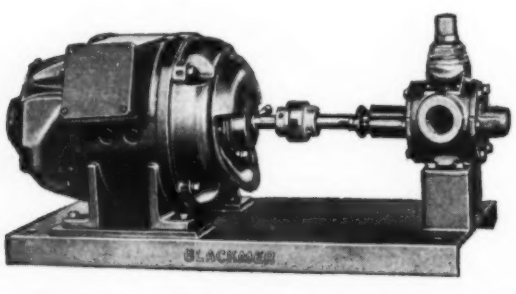
THE Government needed magnetic starters for auxiliary pumps on mine-sweepers—starters to withstand the rolling and pitching of these small craft on heavy seas—starters so designed that accidental closing could not happen under these conditions.

EC&M had a commercially proven, spring-loaded contactor of proper size—one which was held in the "open position" by a spring. The need was urgent—EC&M quickly designed starters to "meet the situation."

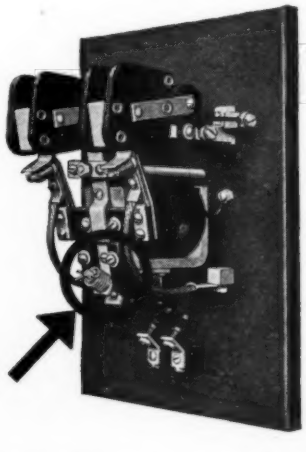
On many phases of the war effort, EC&M Contactor Control is giving a splendid account of itself on vital projects of extreme interest. Some day, perhaps, the story can be told.



Typical EC&M D-c Starter with single-pole, spring-loaded contactors, front-connected resistors and drip-proof cabinet

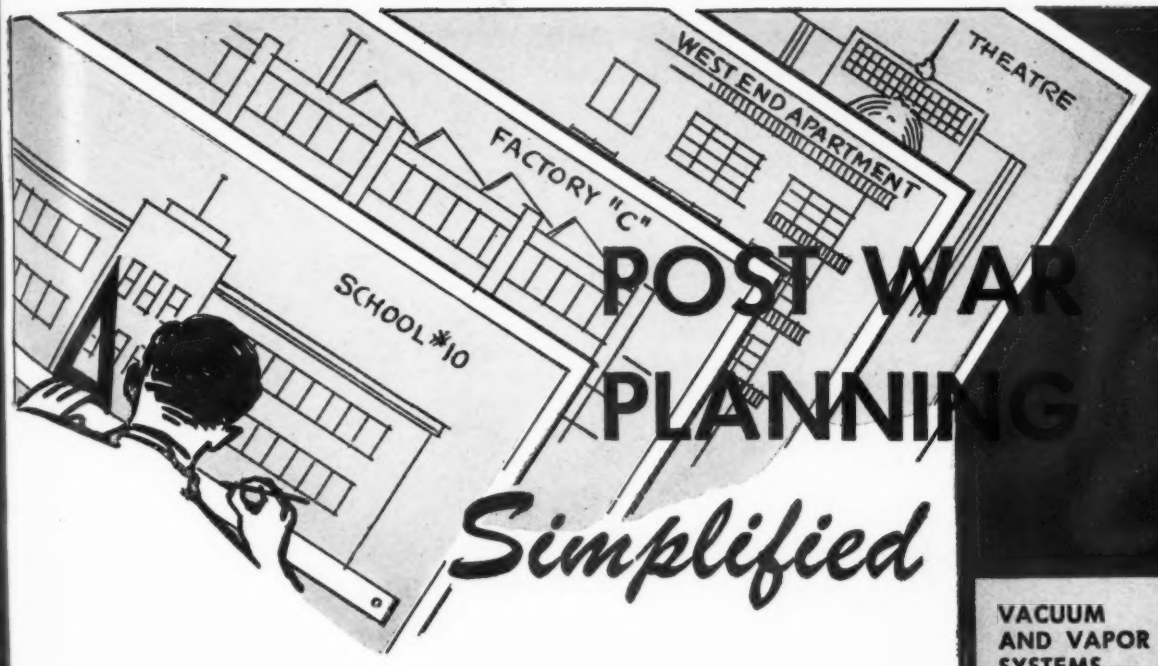


Blackmer pump unit of the type used for naval auxiliaries.



Showing location of spring on EC&M 50-ampere Contactor of double-pole design.

THE ELECTRIC CONTROLLER & MFG. CO.
2700 EAST 79th STREET ★ CLEVELAND 4, OHIO



POST WAR PLANNING *Simplified*

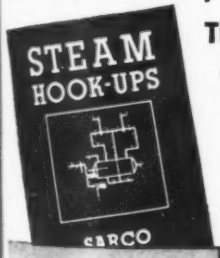
Heating engineers, architects, and factory managers who are now working on plans for post-war construction or adaptation of plants for peace time production are invited to take advantage of our thirty years specialized experience in steam utilization.

We offer our services in connection with the following—without obligation, of course!

Heating: Complete data on the best type of heating system for any building. Sarco makes equipment for steam systems of the gravity, vapor, or vacuum types; for hot water heating with fully automatic weather control, and for radiant or panel heating. Also a wide experience in the correct installation of fan type air conditioning systems and unit heaters.

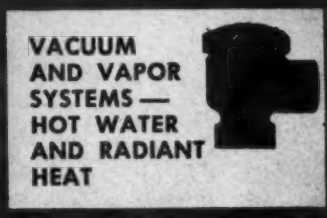
Hot Water Service: We can help you select the most efficient water heaters for domestic or industrial service and can offer simple control equipment which will make operation safe and automatic.

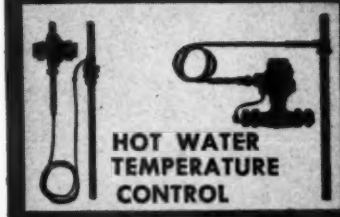
Process Heating: Efficiency of any process involving heating by steam depends greatly on speedy removal of air and condensation and on suitable temperature control. Sarco's specialized experience in applying correct steam traps and controls to all types of process equipment is at your service, whether you contemplate new installations or remodeling.



The Sarco Hook-Up Book: Contains practical information on proper selection of traps and control and many layouts not available elsewhere. A copy is yours for the asking.

5





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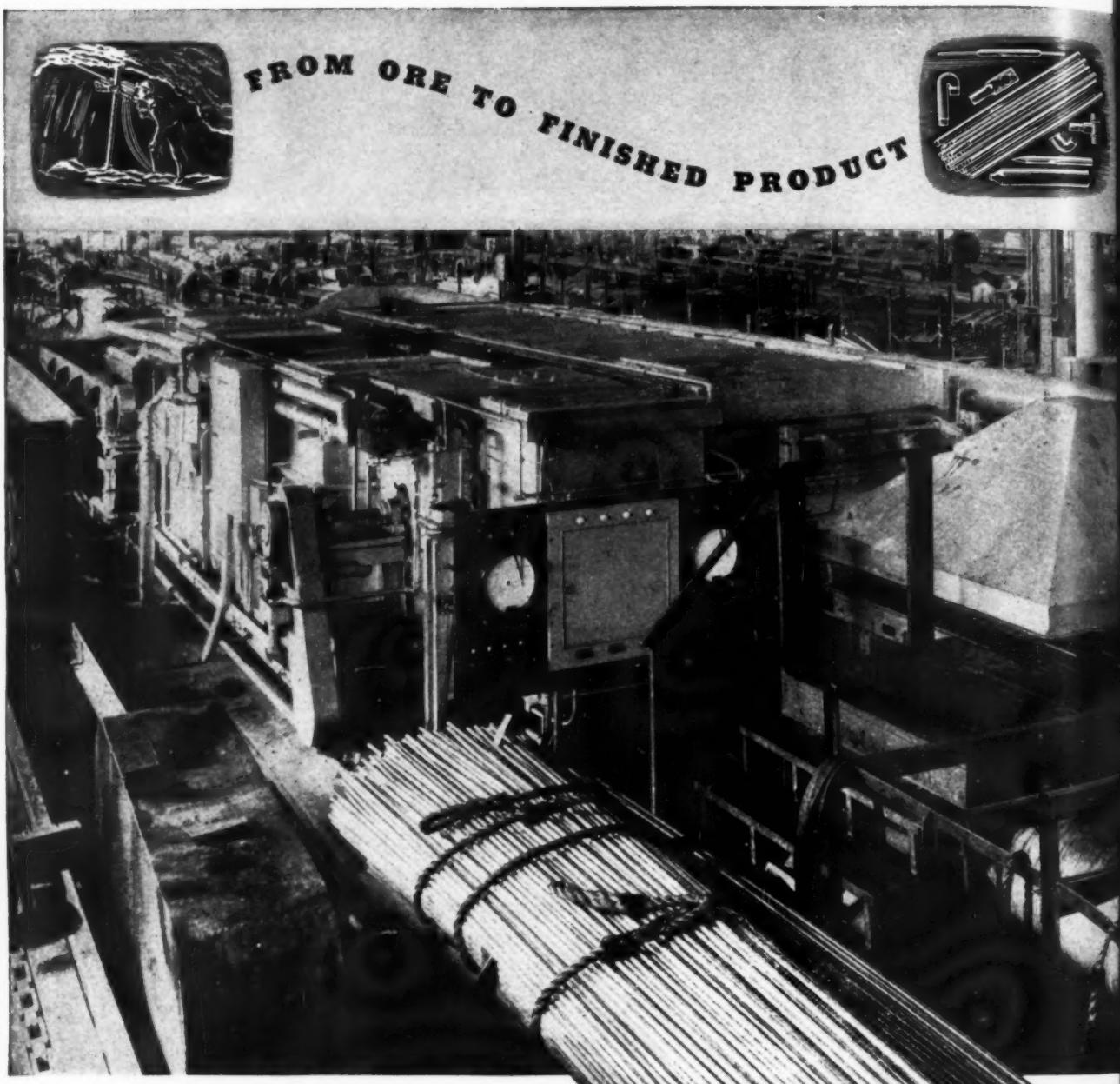

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Silent exhaust *means* more efficient man-hours . . .

It is well recognized today that excessive noise can be an important factor in reducing the efficiency of plant personnel. Maxim Silencers can reduce engine exhaust roar to a whisper, thus eliminating one of the most penetrating and nerve jangling rackets present in plant operation.

To the organizations unable to secure high enough priority ratings to get Maxim Silencers today, The Maxim Engineering department offers a consultation service that can often result in quieter operation of your present equipment. Simply give full details and write to The Maxim Silencer Co., 92 Homestead Ave., Hartford, Conn.

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Success Story:

$1,000 Saved On Original Installation Costs—When A Morse Silent Chain Drive Was Selected For This High Speed (3600 RPM) Power Transmission Job —Continuous 18 Hour Per Day Service For 3 Months Demonstrates Replacement Savings, Many Morse Merits To Skeptical Plant Operators

FROM A LETTER RECEIVED BY MORSE, referring to the Hammermill drive above . . . "This Morse Chain Drive saved us about $1,000.00 in original cost—the cost of two out-bearing extensions and machinist's labor cost of installing them. Further, from our experience to this writing after about 3 months' continuous 18 hour per day operation, we feel certain it will also save the cost of periodical replacement of 33 other type drives.

"We have not yet had the opportunity to make a check on comparative power expense but all indications point toward more economical power transmission.

"Frankly, we at first were skeptical as to the practicability of a chain drive for high speed transmission (3600 RPM) but 3 months' use of Morse Chain Drive for this purpose has eliminated any doubt in this connection.

"Thank you for the time and patience you have given toward helping us work out the problem we had here."

For Post War Planners: Near you, there's a Morse man who will be glad to discuss power transmission problems with you—to help you plan better, more efficient power drive equipment.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA, N. Y. DETROIT, MICH. DIVISION BORG-WARNER CORP.

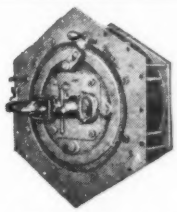
No. 5 in a series of tributes to America's War Industries

TWO-MILE CURTAIN OF HOT STEEL...GOING UP!

With desperate fury they dive in . . . trying to break through to bomb their target. But these Nazi bombers get just so far, then—WHAM! . . . they crash into a curtain of hot, tearing steel. For down there on the ground is a ring of American anti-aircraft guns . . . each one hurling more than a hundred two-pound shells two miles into the sky—every minute!

The performance of our high calibre, rapid-fire anti-aircraft guns is amazing. But even more remarkable is the production achievement that has made these guns possible.

To produce such intricate mechanisms on a mass scale was a stern challenge to American industry. Just how well this challenge has been met is, of course, a military secret. But on every fighting front, the mounting number of dead Nazi and Jap airmen is mute testimony to the job that has been done . . . a job that reflects the ability of America's industrial might to produce whatever is necessary for victory, be it planes, tanks, ships, shells or guns.



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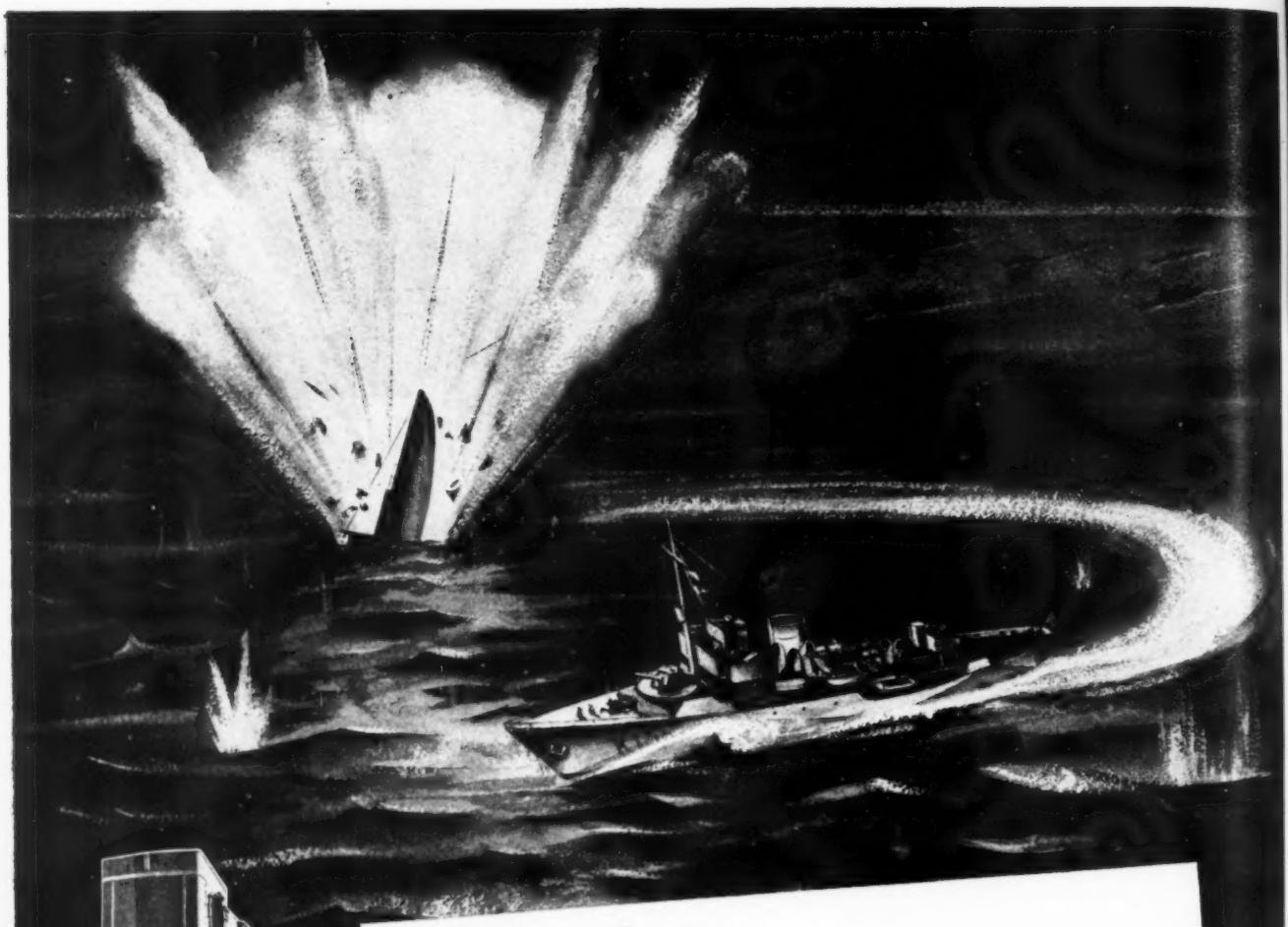

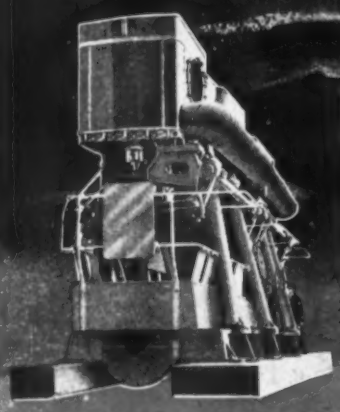

The Iron Men of HENDY are building reciprocating steam engines, for both the Navy's new, corvette escort vessels and Liberty ships; steam turbines and reduction gears for the larger cargo-carrying ships. These are all being manufactured in modern shops, built and fully equipped to produce large units in volume, by streamlined, mass-production methods.

Prelude to SAFETY OF THE SEAS..

This Jap sub had a "blind date" with one of the Navy's newest fighters but didn't know it until his inquiring periscope showed above the waves...then a quick pass...a terrific explosion...and there was one less sea marauder for the cargo ships to worry about.

That's the dramatic side of the war...the part that helps to inspire the entire Hendy organization to build the engines for these speedy escort craft...better and faster. There's a lot of drama too in building engines, especially when you are building for both fighting vessels and cargo ships. We like to think that every hour we save in the foundry, in the machine shop, or on the assembly line brings final victory that much closer...brings that day nearer when cargo ships will truly be the United States *Merchant* Marine, carrying peacetime products to every port in the world.

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ESTABLISHED 1856

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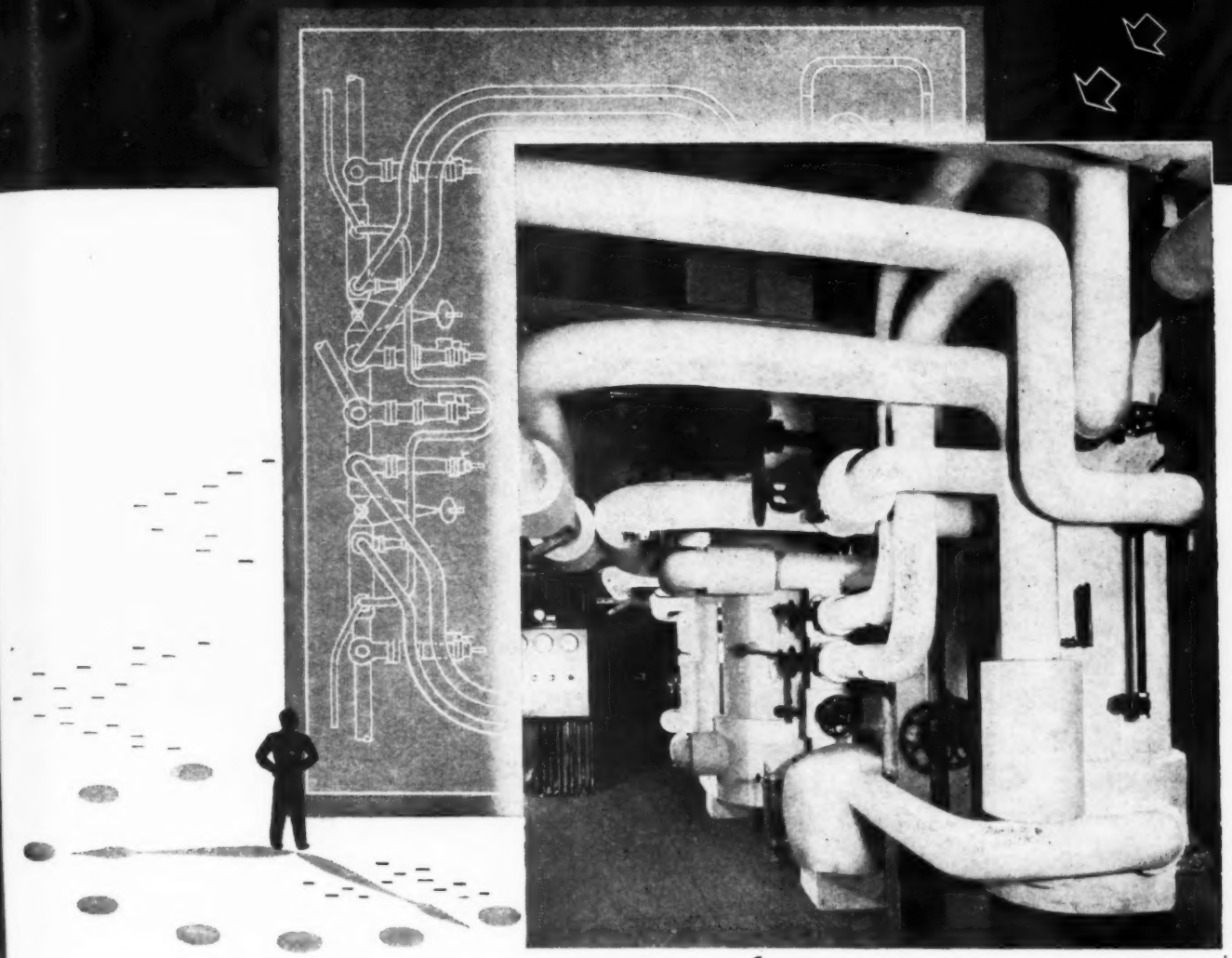
from BLUE PRINT to FINISHED INSTALLATION



MANY factors enter into the correct design, efficient fabrication and erection of a complete piping system. It is essential that *all* of the work be entrusted to a company qualified through years of successful experience in every phase of piping work.

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Pittsburgh Piping and Equipment Company's forty years of successful experience in research, engineering and development, in the fabrication of *single unit* or *complete piping systems* qualifies us to make recommendations concerning your every piping requirement. Replacements, improvements, or additions to present equipment should be planned with an eye to future specifications. Let our engineers help you in your planning. Contact our nearest representative or write us direct. There is no obligation.

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Vick Chemical converts to IRON FIREMAN

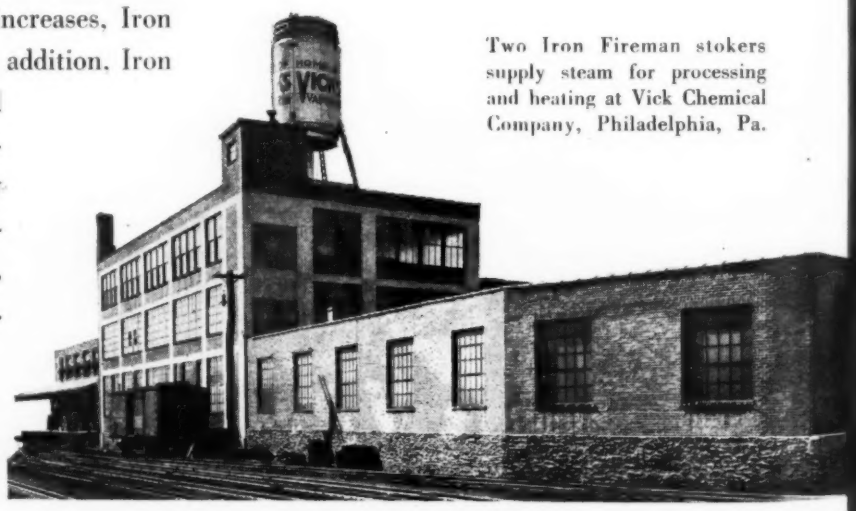
Averts Threatened Fuel Shortage

THE executives of the Philadelphia plant of Vick Chemical Company decided that conversion to coal, America's plentiful fuel, was necessary to insure continuous operation. Steam is required for processing, heating water, air conditioning, humidifying and heating the building.

Iron Fireman automatic coal stokers were installed in August, 1942. Near-record cold weather this past winter made the heating load larger than usual, and steam requirements for manufacturing were greater than ever before. In spite of these increases, Iron Fireman stokers handled the load. In addition, Iron Fireman's automatically controlled firing met the problem of rapidly changing steam requirements for cooking raw materials. It has cut fuel costs, thus reducing coal tonnage, transportation, and thereby aiding our war program.

Easy to Change to Iron Fireman Coal Firing

If you are faced with fuel changes or increased steam loads, find out how quickly Iron Fireman equipment can be installed. Iron Fireman engineers are ready to make an immediate survey of your steam plant. No obligation. Iron Fireman Manufacturing Company, Portland, Oregon; Cleveland, Ohio; Toronto, Canada.



Two Iron Fireman stokers supply steam for processing and heating at Vick Chemical Company, Philadelphia, Pa.

IRON FIREMAN

THE IRON FIREMAN

Automatic Coal Stokers

Sufficient space was not available at the front of the boiler and the Iron Fireman stoker was installed through the side of the furnace.

'Our Iron Fireman automatically controlled coal stokers now handle a rapidly fluctuating load that is even larger than the demand which was carried by our former firing system.'

James Wood

Power Plant Supervisor
Vick Chemical Co.

JAMES WOOD, *Power Plant Supervisor* at the Vick Chemical Company plant.

IRON FIREMAN STOKERS ARE AVAILABLE—*Write for Information*

Output of Iron Fireman commercial and industrial stokers has been substantially increased to equip heating and power plants converting from oil, hand-fired coal and gas. Our nationwide organization of qualified factory representatives and dealers is at your service. Write for literature. Iron Fireman Manufacturing Company, 3506 West 106th Street, Cleveland 11, Ohio.

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EHRET'S 85% MAGNESIA and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the 176-page Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy.

Whether they be for fast firing anti-aircraft guns, for small arms or for 16" naval giants, gun barrels are invariably made of steel. This is the one and only material which time has shown to be capable of withstanding the heat, the stress and the abrasion of artillery service.

And similarly, in the field of thermal insulations, there is one best material for industrial service, namely . . . 85% Magnesia. Service records ranging back beyond the turn of the century attest the permanently-high thermal efficiency, the long life and the overall economy of this material. It will pay you to bear this fact in mind when specifying insulations and it will pay you to continue to use Ehret's 85% Magnesia.

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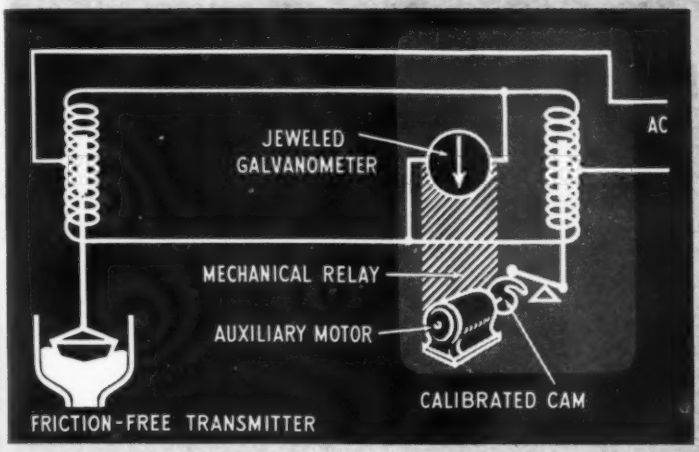
. . . THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA



In the Cochrane Flow Meter, the Null or Zero Balance principle is employed, balancing the unknown quantity by adjusting a known quantity of the same kind. A highly sensitive detector is used to determine the point of balance. A friction-free transmitter serves as a pilot for an external motor drive. The motor restores the bridge to balance and operates recording pen, indicating pointer, and integrator. The measuring circuit is relieved of all work.

Another Low Maintenance Feature ---the Large Reservoir Pen

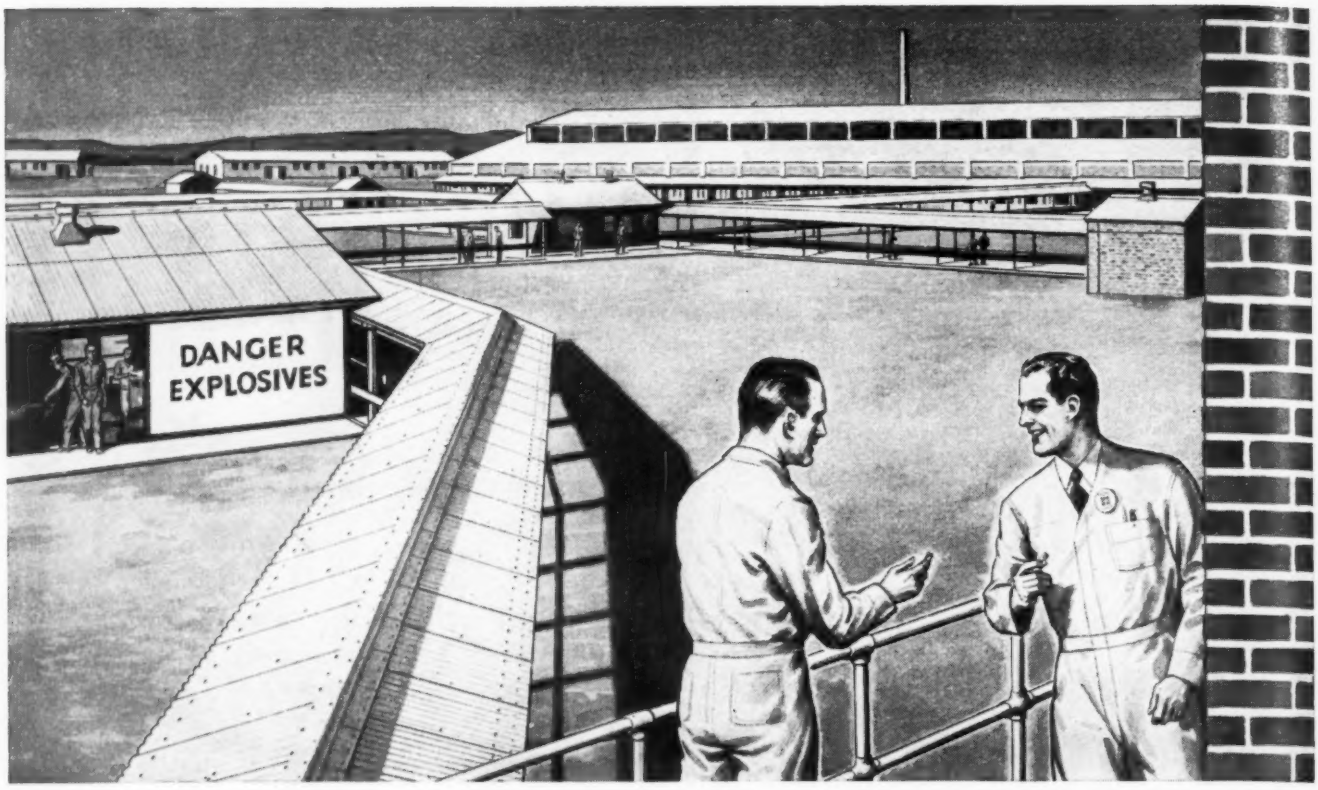
The giant glass pen in the Cochrane Flow Meter recorder is another of the many features designed to minimize the amount of attention required in the operation of the meter. The reservoir holds a month's supply of ink. The point is tipped with platinum-iridium, for almost indefinite wear.

For other Cochrane features, see Cochrane Publication 3010. A copy will be sent upon request.

COCHRANE CORPORATION
3120 N. 17th St., Philadelphia 32, Pa.

COCHRANE FLOW METERS

Looking ahead with Asbestos



85 ACRES OF K&M *"Century"* ASBESTOS CORRUGATED for a famous arsenal

It was an immense, urgently needed wartime project. Speed was paramount. The roofing and siding had to go on with no loss in erection time, and it had to provide permanent protection and uninterrupted service for this vital war production plant.

K&M "Century" Asbestos Corrugated met every qualification and approximately 1,000,000 square feet went into place on time . . . enough material to cover an area of 85 acres. This tremendous quantity is only a fraction of the many millions of square feet of "Century" flat and corrugated asbestos sheets that have been used for wartime construction to date.

K&M "Century" Asbestos Corrugated is produced by applying tremendous hydraulic pressure to a combination of asbestos fibre and Portland cement. The result is a truly maintenance-free sheet . . . a material highly resistant to fire and weather.

Previously, all our output of K&M Asbestos Corrugated was reserved for essential war needs. But having met many of these urgent obligations, we can now supply this remarkably adaptable, time-and-money-saving material for general use.

Wartime research at K&M continues to uncover new processes and products, and we are looking forward confidently to the rewards of these achievements in the "V" years to come.

* * *

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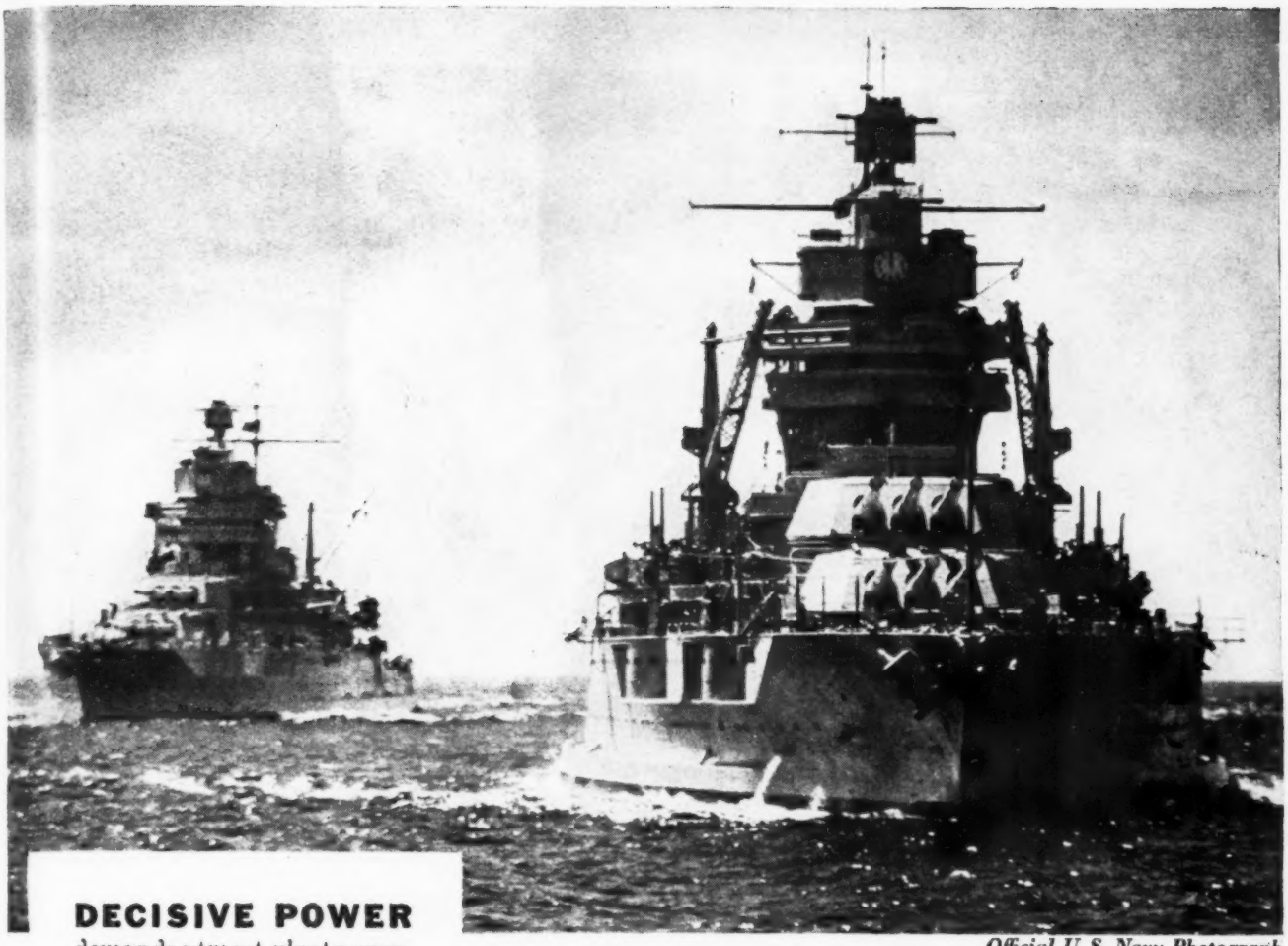

Official U. S. Navy Photograph

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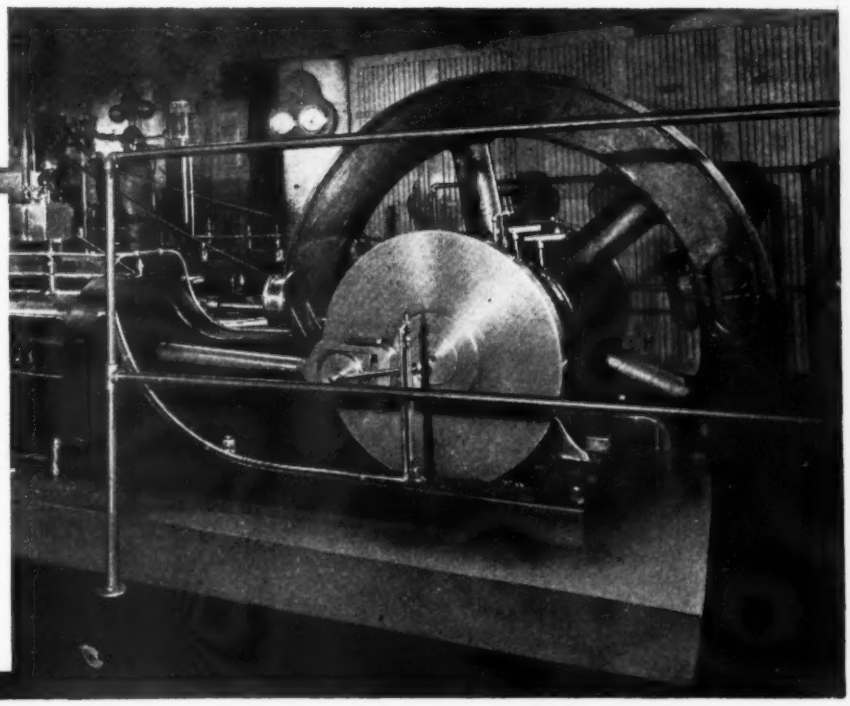

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. They are suited to all engine designs and operating characteristics . . . give economical lubrication under the most difficult service conditions.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

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Constantly subject to all the known stresses and strains of present-day production, your power transmission also must be sturdy enough to meet and conquer the "unpredictable" . . . those unforeseen factors which are encountered daily in the busy plant.

Let us give you the proved benefit of our nearly 90 years' experience in supplying truly satisfactory Power Transmission Equipment.

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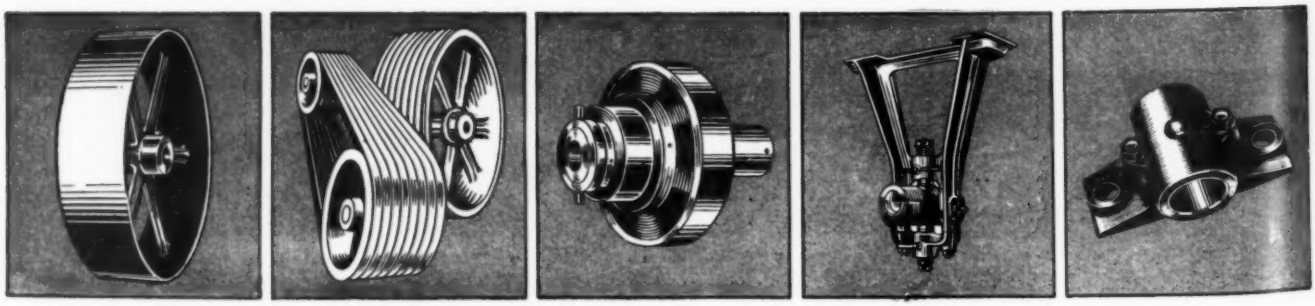

The First Line of Defense

No matter how badly the steel mills need scrap, a turbine or boiler will aid the war effort more by staying on the job than by going on the scrap pile.

Inactive equipment . . . equipment nearing condemnation . . . often can be made to serve you for many more months and years when protected — the quick, easy, low-cost way — with APEXIOR. And new equipment can be preserved at peak condition by this essential maintenance and operating material.

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APEXIOR is the safe, sure answer to lack of new equipment — the solution to your problem of getting more out of your present equipment. APEXIORIZE — you'll save valuable metal — and in the case of boilers, you'll lengthen periods between cleaning and make cleaning easier (with a wire brush).

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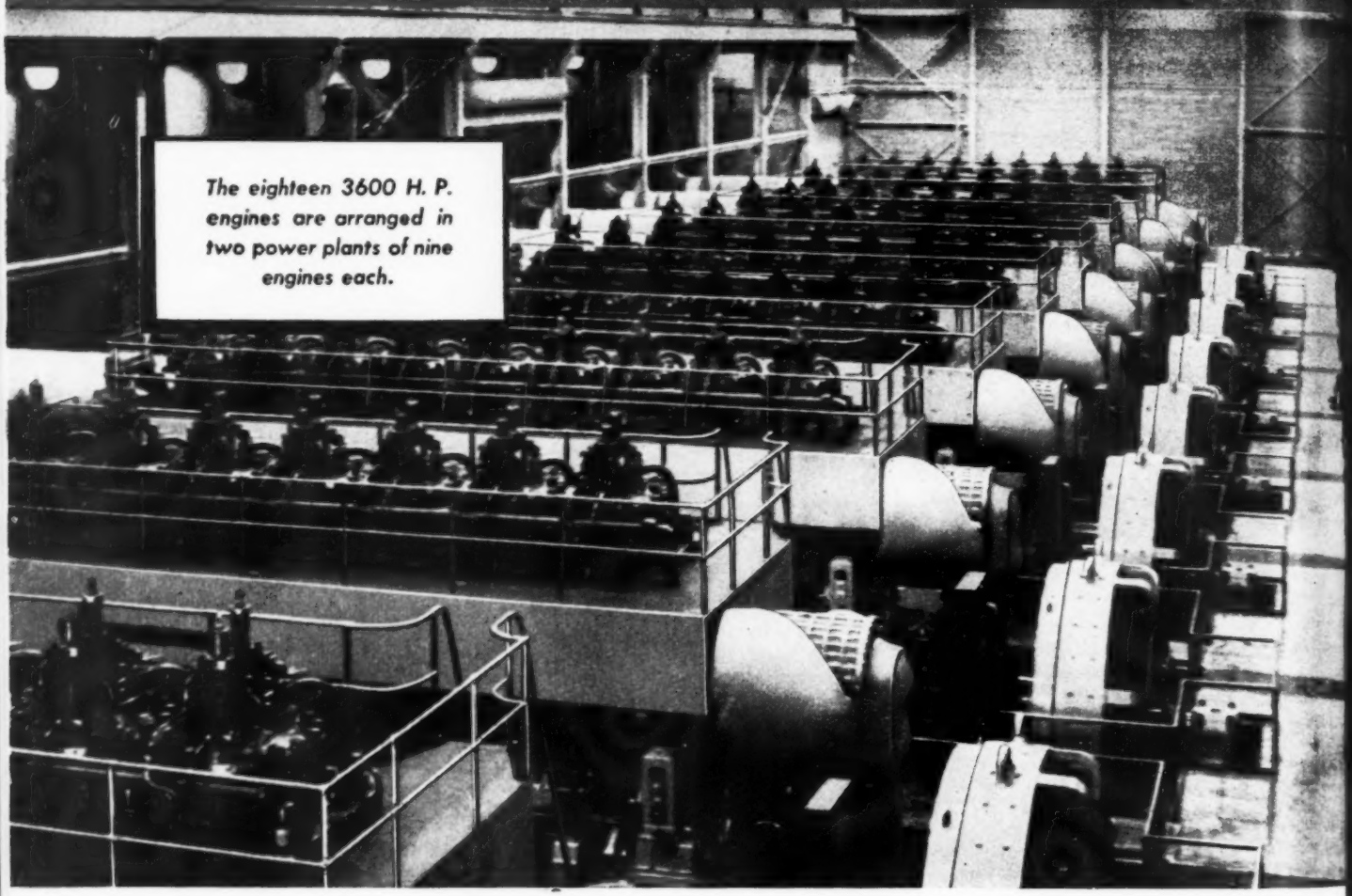
The WORLD'S LARGEST D

Eighteen Engines



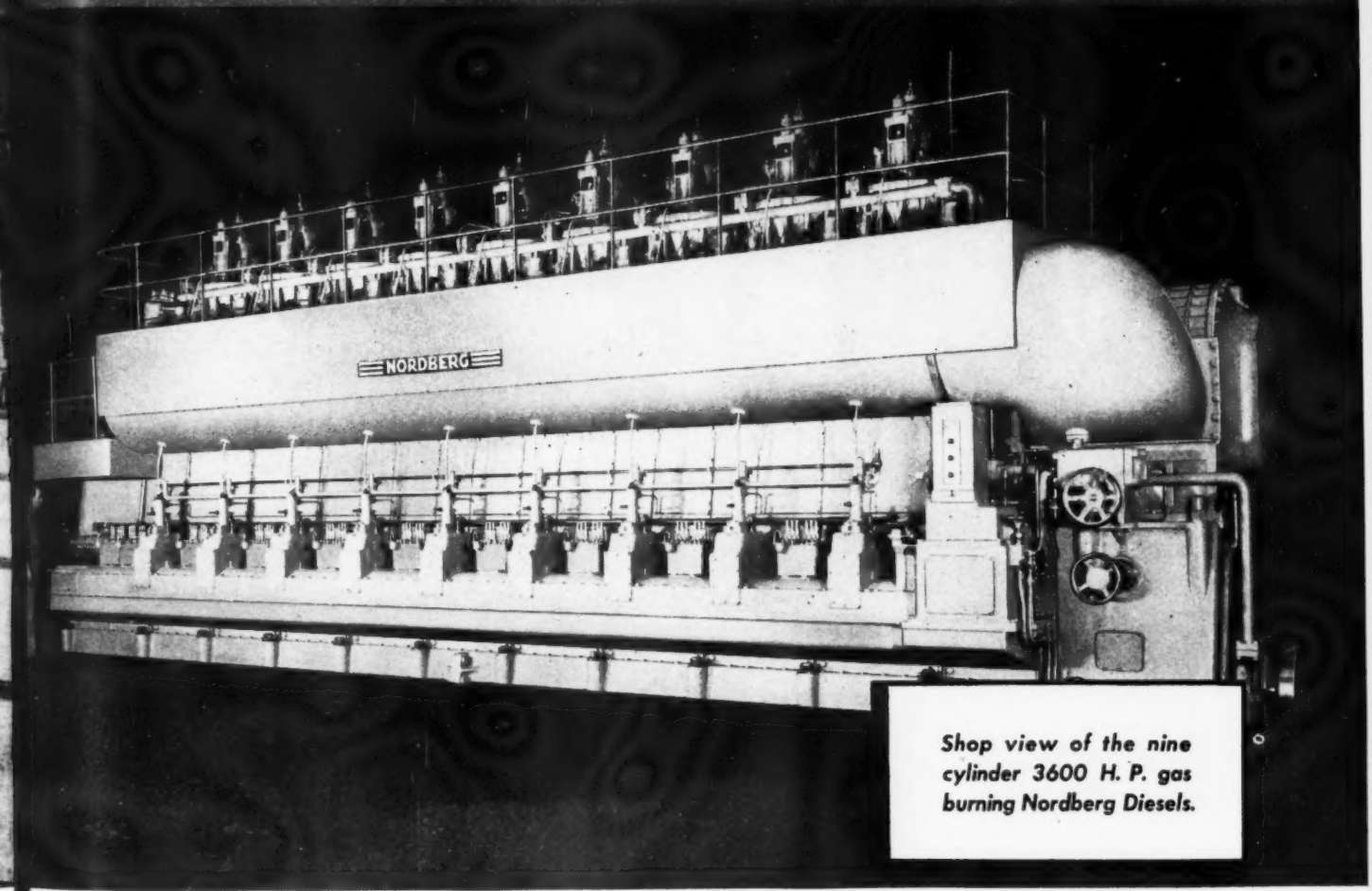
The eighteen 3600 H. P. engines are arranged in two power plants of nine engines each.

The selection of Nordberg engines for the world's largest Diesel engined power plant is added proof of the dominant position held by Nordberg as builder of Diesel engines in the larger sizes. These eighteen engines are part of our vital aluminum expansion program and were selected because of their ability to produce dependable power at low cost, an all important factor in the recovery of this metal so essential to the war effort . . . Because of wartime regulations, censorship prevents mention of the location of this installation which is furnishing an unfailing supply of energy and is giving the kind of performance that is being given by other installations of large Nordberg Diesels which have gone in service in recent years.

NORDBERG *Gas Burning* D

DIESEL INSTALLATION

65,000 Horsepower

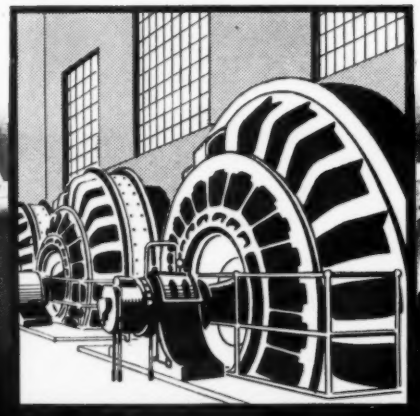


Shop view of the nine cylinder 3600 H. P. gas burning Nordberg Diesels.

The engines installed in this record size Diesel power plant are of the gas burning type, a recent development which Nordberg has contributed to the Diesel power field. This type of engine operates on the full Diesel principle but burns natural gas. These gas burning Diesels, however, may be changed at any future time to oil burning without changing a single major engine part. The satisfactory performance of Nordberg gas burning Diesels now in service prove conclusively that this type of engine has outstanding merits wherever natural gas is available.

NORDBERG MFG. CO. • MILWAUKEE 7, WIS.

DIESEL ENGINES



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Technical design and sound planning met the challenge of Pearl Harbor—to out-produce our enemies who had a seven-year head start. Industry demanded power—more and more power—they got it, to the tune of 65 million "horses."

Behind this unparalleled increase in power capacity is the aggressive engineering of men who recognized their responsibilities—men who knew power plants must be designed—*not just built*. Whether it is electricity, steam, diesel, hydraulic or natural gas, Pritchard Power Engineers are thoroughly capable of designing and constructing the plant best adapted for the power to be used. J. F. PRITCHARD & COMPANY—*Power Division*—Fidelity Building, Kansas City, Missouri.

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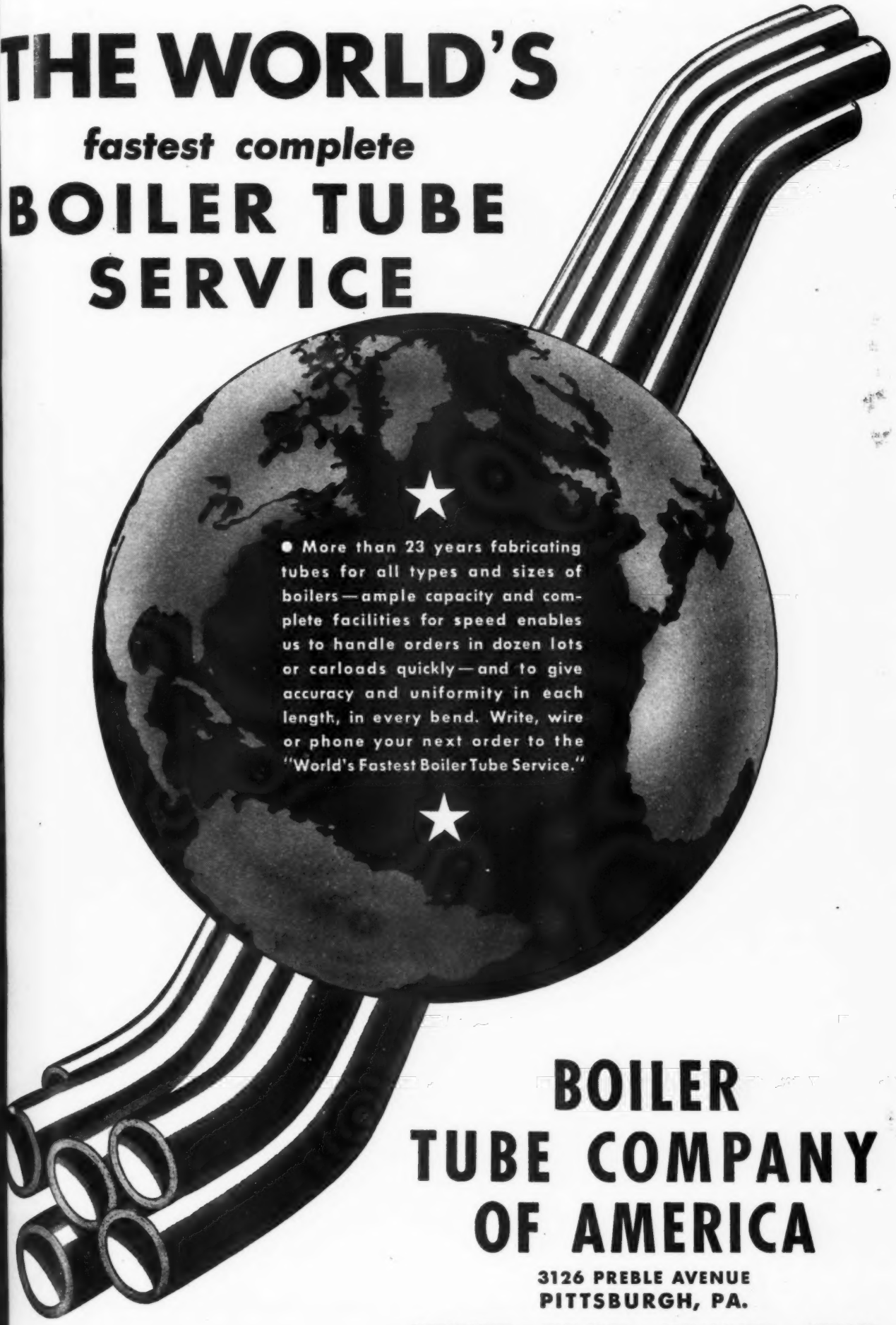
BOILER TUBE SERVICE



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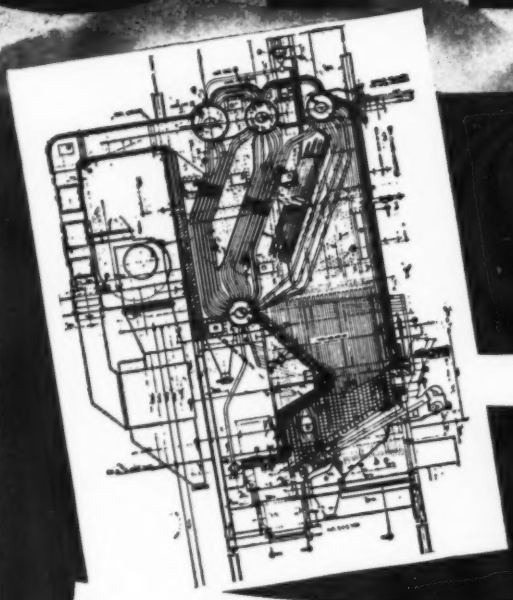
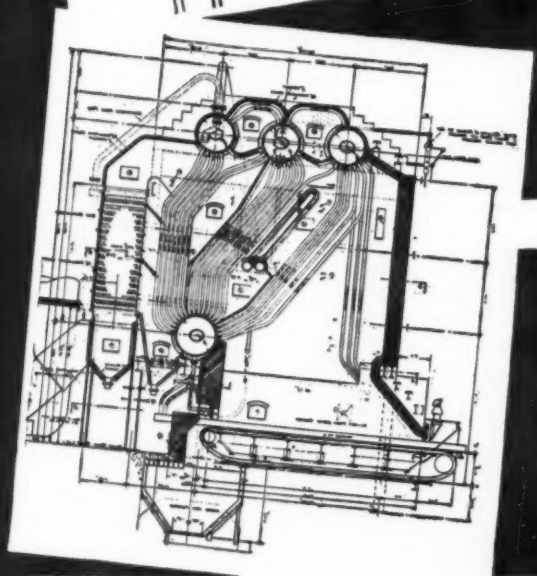


POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.

•

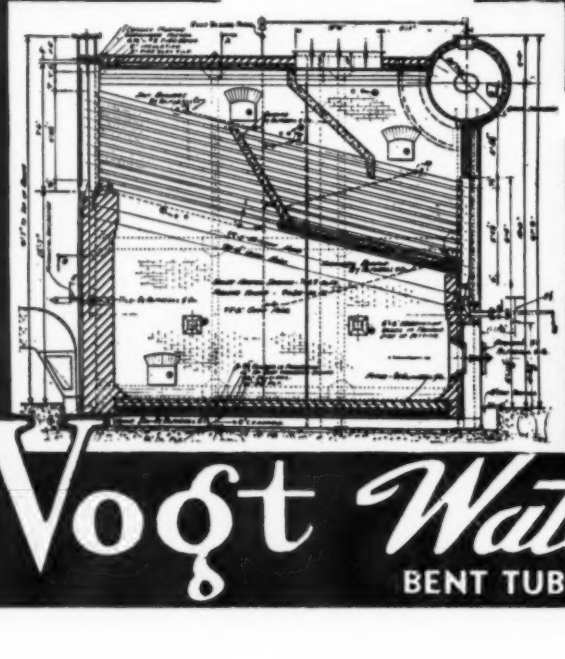


PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.

•



HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND
CHICAGO PHILADELPHIA TULSA

Vogt *Water Tube* BOILERS

BENT TUBE AND SECTIONAL HEADER TYPES

"Your life-line

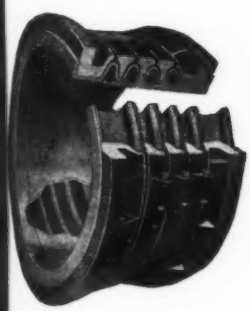
is perfectly formed . . . UNIFORM—no thick-and-thin sections . . . *ALL-CURVE*—no weak corners or 'junctions.' I see a long life ahead for you."

SINCE 1841 we've learned a lot about working sheet metals and tubing into all manner of shapes *without dangerous forming stresses.*

In putting those deep corrugations into copper or stainless steel tubing to form Badger Corrugated Expansion Joints, no "shock" methods are used . . . no hammering, forging or sharp die-pressing to stretch or weaken the metal.

Badger joints are "babied" into shape—a step at a time—by special Badger-perfected means and under scientific heat-treatment during fabrication.

Result: Into your pipe line goes a joint that is uniformly resistant to temperatures and pressures, and as responsive to expansions and contractions as modern engineering can make it. . . . A joint with *ALL-CURVE* corrugations—no straight sides or "junctions" to encourage localized stresses. . . . A joint that will retain its flexing characteristics under long and severe use.



BADGER DIRECTED FLEXING SELF-EQUALIZING EXPANSION JOINTS — *ALL-CURVE* Equalizing Rings not only control and limit the flexing movement, but reinforce the joint to far beyond the "safety" point. For long traverses. Copper for normal pressures and temperatures. Stainless Steel for higher pressures and temperatures, and for extra corrosion resistance. *Bulletin No. 100.*

BADGER NON-EQUALIZING (packless) EXPANSION JOINTS —with single or multiple corrugations (Copper or Stainless Steel) for lines where pressures do not exceed 25 pounds and traverses not exceeding ½". Also used to absorb strains, vibrations and distortions between connecting equipment. *Bulletin No. 200.*

• • •

FREE BADGER BULLETINS (see left) tell more about the *ALL-CURVE* Corrugations, *ALL-CURVE* Equalizing Rings, Directed Flexing, "Packless" and other features of Badger Corrugated Expansion Joints.

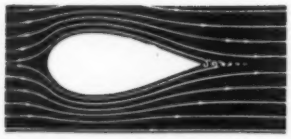
IF IT'S **BADGER**-MADE IT'S **GOT SOMETHING!**

E. B. Badger & SONS CO.

75 PITTS STREET, BOSTON, MASS.

AGENTS IN PRINCIPAL CITIES

BADGER CORRUGATED EXPANSION JOINTS



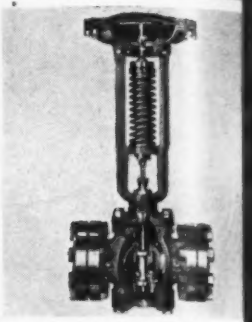
"Even though shifts come one after the other nowadays, yours truly stays on the job. Once they put me on the line I am IN — they don't find me out of order — no time-outs for repairs. I have accuracy and capacity. Peak loads or sharp changes in demand don't bother me. Why I have been known time after time to have been on the line so many years without needing even a little attention that the boys in charge forgot all about me. If they had a time card for me it would have shown a big zero after the word 'absenteeism.' Guess it's what a fellow is made of after all that counts — I am free of small ports and passages and complicated mechanism — also I have but few close fitting parts. The big secret is that I am Streamlined."

TROUBLE-FREE SERVICE	CONSTANT DELIVERY PRESSURE
SMOOTH OPERATION	PRACTICALLY ZERO IN MAINTENANCE COST
TIGHT CLOSURE	SPEEDIER PRODUCTION RESULTS
NO SPOILAGE	COST-SAVING OPERATION

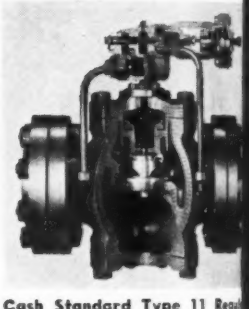
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

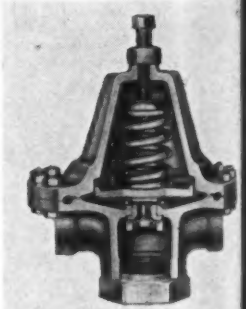
OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34, Pressu Reducing Valve. For practica all fluids. Sizes: ½" to 12" clusive. Highest initial pressu 800 lbs.; reduced pressure, va uum to 150 lbs.
Has roller guides, roller bear — no lost motion.
Bodies: iron, bronze, steel. Tri iron, bronze, stainless steel. En screwed, flanged, ammonia typ welding type.

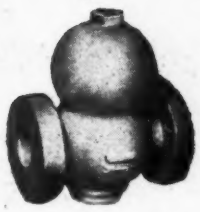


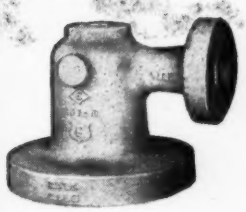
Cash Standard Type 11 Regu tor, for use with water, air any gas or oil that is non-co rosive. Pressure to actuate pil valve may come from any sourc and be as high as 1500 lbs.
Inlet pressure up to 600 lbs outlet pressure up to 250 lb Sizes: 2" to 12".



Type 8871 Pressure Reduci Valve; for use with liquids— pecially dirty liquids, like Bunk C fuel oil for example. No slidi fits; inner valve bolted to di phragm for positive movemen Initial pressure up to 250 lbs reduced pressure up to 200 lb Bodies: iron, bronze or ste Renewable inner valve and se ring, stainless steel. Sizes: ½ ¾", 1"

SIVYER STEEL CASTINGS





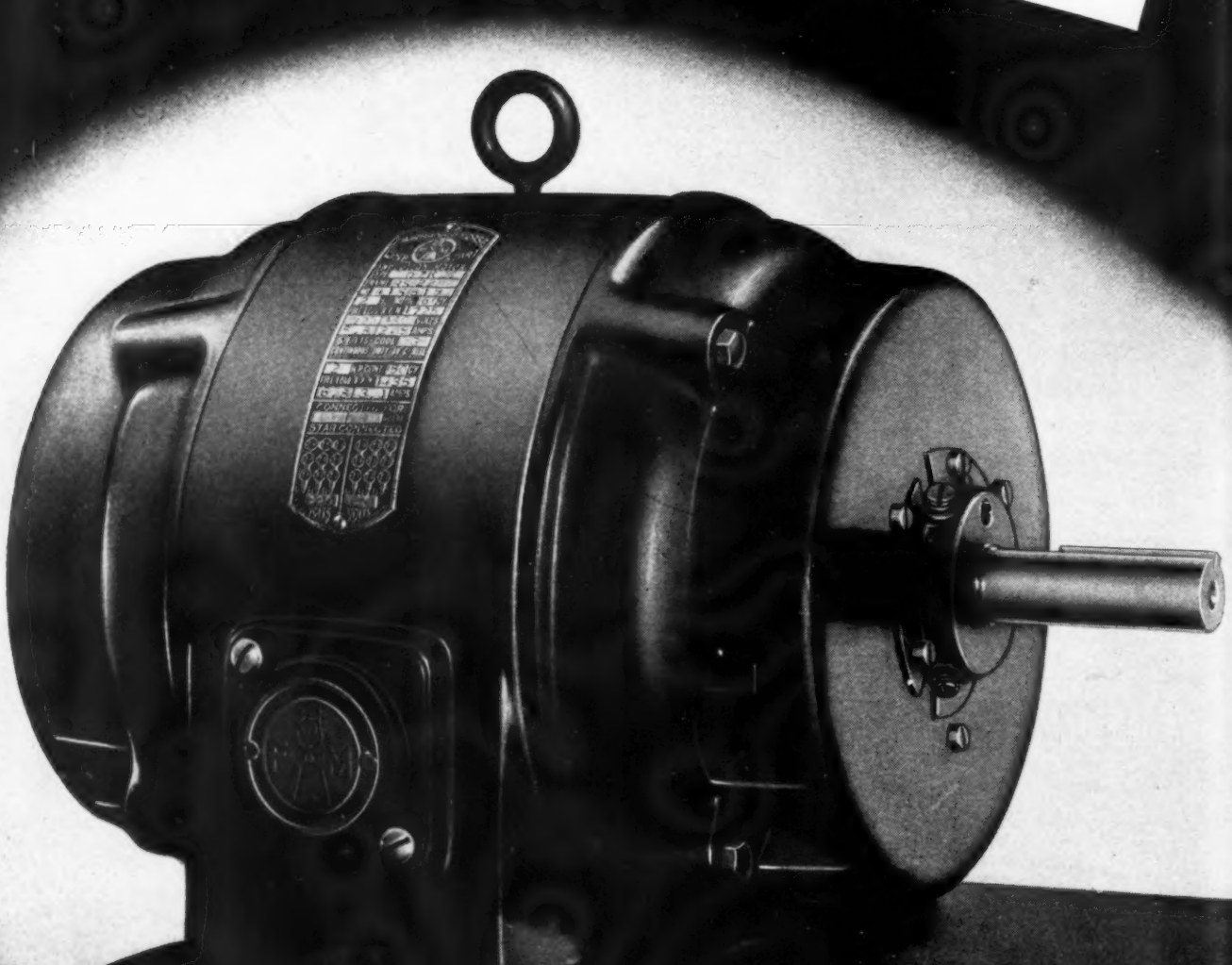
Good coremaking helps make worth looking for . . .

The steel founder can't depend on patents or on originality of design to assure quality of product. He must rely instead on the use of good foundry equipment plus skill in the many crafts which have a part in foundry practice. And of these crafts none is more important than coremaking. Sivyer coremakers are given the best, the most modern tools with which to work; they are given long training and careful supervision. That's why you'll find that Sivyer castings, even before finishing, are clean, true to pattern, accurate in contour. Just another reason why the Sivyer trade mark is worth looking for when you want good steel castings.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY

NEW



WITH *Copperspun* ROTOR

FAIRBANKS - MORSE

MOTOR

Here is a motor—different from any you have ever seen.

It is a challenge to future motor design—because it includes more versatility, more stamina, more protection than was ever put into one housing before.

- **It is a 40°C motor—with a ventilating system you will want to know about!**
- **It is a protected-type motor!**
- **It has the most adaptable, convenient, and handiest conduit box you ever laid your eyes on!**
- **It has the famous Fairbanks-Morse COPPERSPUN Rotor!**

A demonstration is necessary to fully appreciate the many unique features of this motor.

You will want to know all about this new Fairbanks-Morse Motor—especially if you are now buying motors for a war task but want them to be up to the minute when the time comes for post-war production.

Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill., for full information.

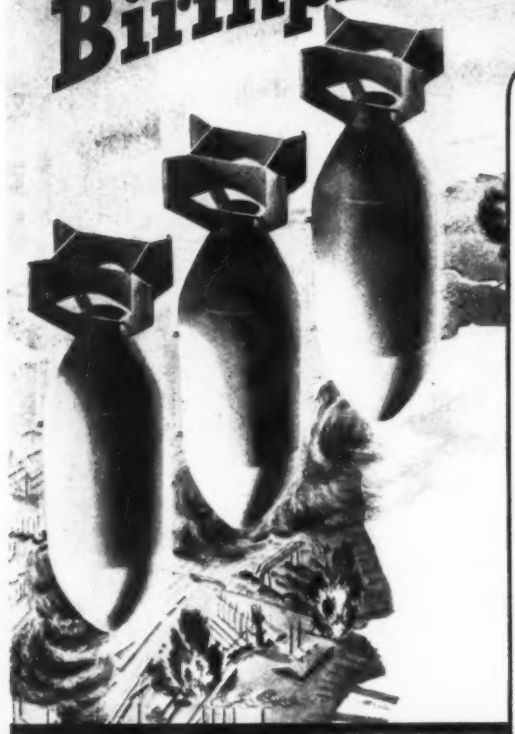
FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

F M

Motors

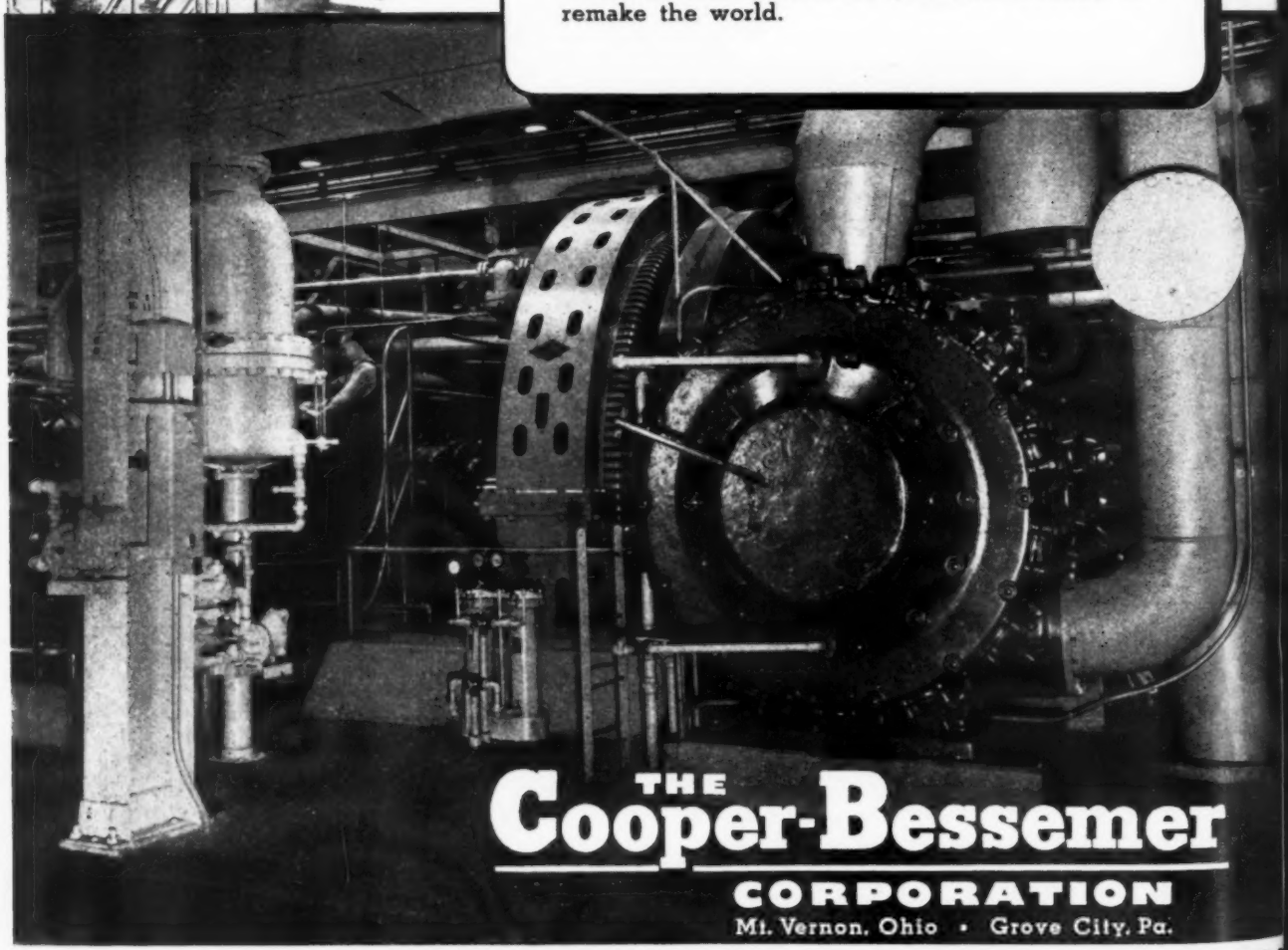
Birthplace of Block Busters



INSIDE these massive tubes and compressor cylinders are gases being formed into synthetic ammonia . . . which in turn will go into high explosives to fill deadly block buster bombs.

These particular compressors were built by Cooper-Bessemer, each driven by a 2500 hp electric motor. They are 5600 c.f.m., 6-stage compressors, developing 5150 p.s.i. pressure. They are installed in a Government Ammonia Plant, where they work night and day, month in and month out, with never a lay-off or a slow-down.

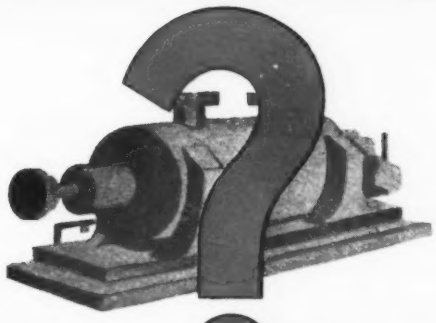
All Cooper-Bessemer compressors and engines are built for long-time, efficient service. Hundreds of thousands of C-B horsepower are working at war jobs in chemical plants, refineries, wherever gases must be handled or processed. After Victory, these same compressors and thousands more now building and still to be built will carry on . . . to help with the peacetime products needed to remake the world.



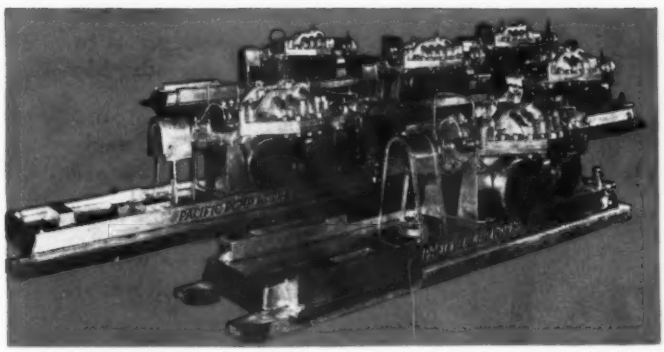
THE Cooper-Bessemer CORPORATION

Mt. Vernon, Ohio • Grove City, Pa.

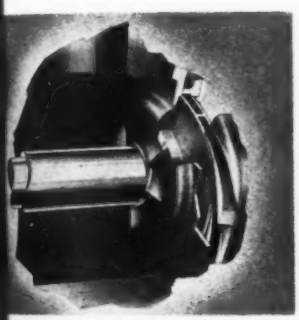
BUILDERS OF DEPENDABLE ENGINES FOR 110 YEARS



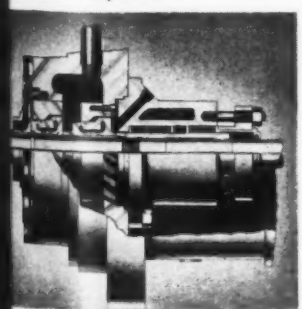
Today ANY PUMP MAY DO



Tomorrow YOU'LL WANT A PACIFIC!



...w of first-stage impeller showing how ...d flow impeller vanes extend out into ...suction eye. Low suction velocities are ...ined through the design of the large ...on bay and large area of first-stage impeller.



...ngement of balanced, stationary, float-...eals for reducing high suction pressure ...ump packing and balancing pump ...t. Parts are corrosion proof and the ...ng faces are hard faced. Several pat-...have been issued on this construction and others are pending.

At present it is not for us to say to whom Pacific Pumps may be shipped. Our instructions and yours stem from one source: the War Production Board. *What* pumps you are able to buy or rebuild is not as important as *when* you get them and if they can be made to operate even temporarily in your particular pumping serving.

But there will come a day when the pumps you are operating now will stop—just as the war will stop. That is the time you'll want to consider the purchase of Pacific Pumps. Before then you'll want to check the performance records of Pacific Pumps now in service. You'll want to study Pacific pre-tested design and engineering features and Pacific's recognized superiority of workmanship, testing and inspection. We will appreciate your consideration and give you the benefit of Pacific "know how" in selecting the pump to do the best job of the future.

Learn why experienced power plant engineers say, "ASK PACIFIC first and you'll do better in the long run."

PACIFIC PUMPS
include
Hot Oil Pumps
Boiler Feed Water Pumps
Turbine Pumps
Refinery Pumps
Reciprocating Oil Well
Plunger Pumps

•

For the Armed Forces
PACIFIC HYDRAULIC
ACTUATING CYLINDER
ASSEMBLIES

PACIFIC PUMP WORKS
PACIFIC
HUNTINGTON PARK CALIF.

PACIFIC PUMP WORKS

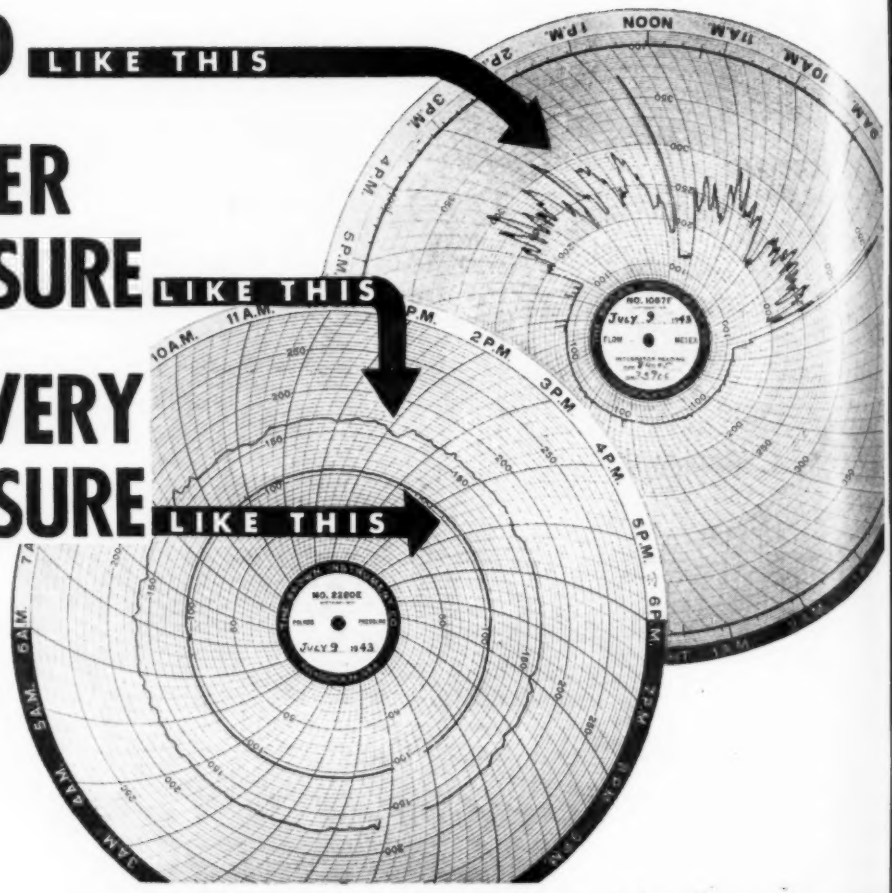
Executive Offices and Plant: Huntington Park, Calif. • *Export Office:* 30 Rockefeller Plaza, N. Y. • *Sales and Service:* Offices in principal cities in the United States • *Affiliated Companies:* Clark Bros., Olean, N. Y.; Dresser Manufacturing Co., Bradford, Penn.; The Bryant Heater Co., Cleveland, Ohio

PACIFIC *Engineered* PUMPS

WITH A **LOAD** LIKE THIS

AND **BOILER PRESSURE** LIKE THIS

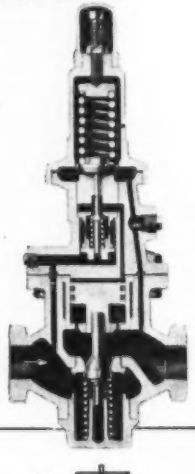
YOU GET **DELIVERY PRESSURE** LIKE THIS

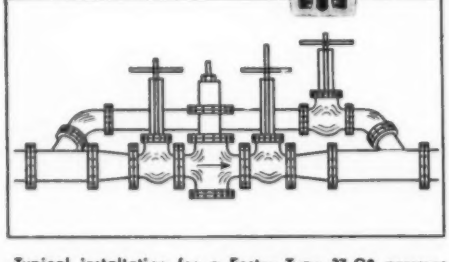


WITH A FOSTER PRESSURE REGULATOR LIKE THIS

FOSTER TYPE 37-G2 PRESSURE REGULATORS

- initial steam pressures up to 1500 pounds
- delivery pressures up to 1200 pounds
- total temperatures up to 900°F
- auxiliary or pilot operated
- wide variety of spring ranges
- alloys to suit pressure and temperature





Typical installation for a Foster Type 37-G2 pressure Regulator. Catalog 70 shows many other installation suggestions and illustrations, including proper control connections and by-pass arrangements.

PERFORMANCE such as this would be considered *good* for a *new* valve—but this 3 inch Foster Type 37-G2 has been in continuous service on a process steam line for over 15 years. Maintenance during this time has consisted of routine checkups and grinding of the pilot valve not oftener than once a year. No parts have been replaced.

This valve is giving satisfactory regulation because it is the right size and type for the job and it was properly installed.

You can count on an equally satisfactory solution to your own pressure reducing problem. Select the proper size and type of valve to fit your requirements and see that it is correctly installed. Our engineers will be glad to help you find the *right* answer—without obligation of course.

•

Illustrated catalog on the complete Foster line with many pages of useful engineering data will be sent if the request is made on company letterhead. Simply ask for Catalog 70.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK 1, N. J.

9-FE-5

What's Behind the Trade Mark?

QUALITY

TRADE MARK

YOUNGSTOWN

SERVICE

Growth Through Service

IN 1909 the capital of The Youngstown Sheet and Tube Company was increased from $6,000,000 to $10,000,000. The financial statement, read at the meeting of the Shareholders at which this action was taken, showed assets of $12,000,000. This represented an amount twenty times the original capitalization of $600,000 as of November, 1900.

$3,000,000 of this new stock was distributed to Shareholders in the form of a stock dividend. $1,000,000 was appropriated for additional expansion. In 1909-1910 there were added to the operation facilities, the third blast furnace, additional tube mills, sheet mills, and wire fabricating facilities. The ore and fuel reserves were augmented and strengthened.

The steady growth of this company had, by this time, attracted national attention. The material evolution of the plans of the men who guided the destiny of this company was the result of that type of genius which springs from hard work directed efficiently and persistently. These qualifications plus the incentive to be of greater service, and the operation of the principle of free enterprise stimulated the steady, healthy and progressive development of this great organization. These principles are as American as the Bill of Rights.

The YOUNGSTOWN SHEET AND TUBE COMPANY, Youngstown, Ohio

Manufacturers of

CARBON · ALLOY AND YOLOY STEELS

Pipe and Tubular Products · Sheets · Plates · Conduit · Bars · Tin Plate
Rods · Wire · Nails · Tie Plates and Spikes · Alloy and Yoloy Steels

CRYSTOLON Brick for Boiler Furnaces

A REFRACTORY LINING WHICH PAYS DIVIDENDS

CRYSTOLON (SiC) Brick are paying dividends to power plant operators by insuring longer service and fewer and briefer shutdowns. Their dense surface cannot be penetrated by slag, making removal of the clinker ring a short, easy operation. CRYSTOLON Brick withstand high temperatures at peak operation and they are chemically inert. Their ruggedness makes them resistant to abrasion such as the motion of the fire bed.

NORTON COMPANY
Worcester, Massachusetts

Norton ELECTRIC FURNACE FUSED Refractories

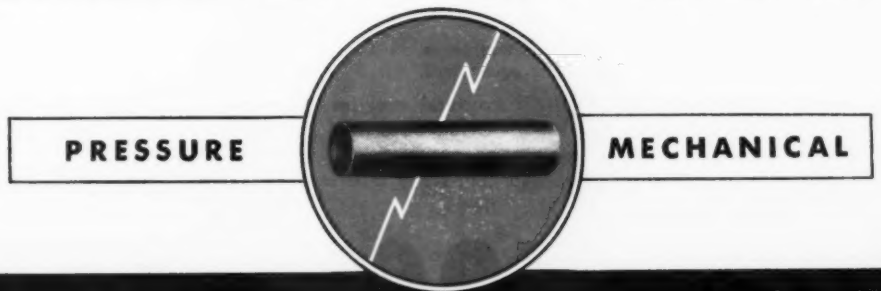
BETTER ELECTRIC WELDED STEEL TUBING

For Today and Tomorrow

PRODUCED ON AMERICA'S MOST MODERN TUBE MILLS

For your wartime applications requiring greater strength and lighter weight, Talon's Electric Welded Steel Tubing is being produced in ever increasing quantities. Sizes now available for reasonably prompt delivery range from ¾" to 4" O. D. in lengths up to 40 feet. It is cold-formed from strip steel on the most modern, precision controlled equipment in existence. Since the accurate gauge and width of the flat-rolled strip are controlled by very close tolerances, the O. D. and I. D. of the finished tube are concentric.

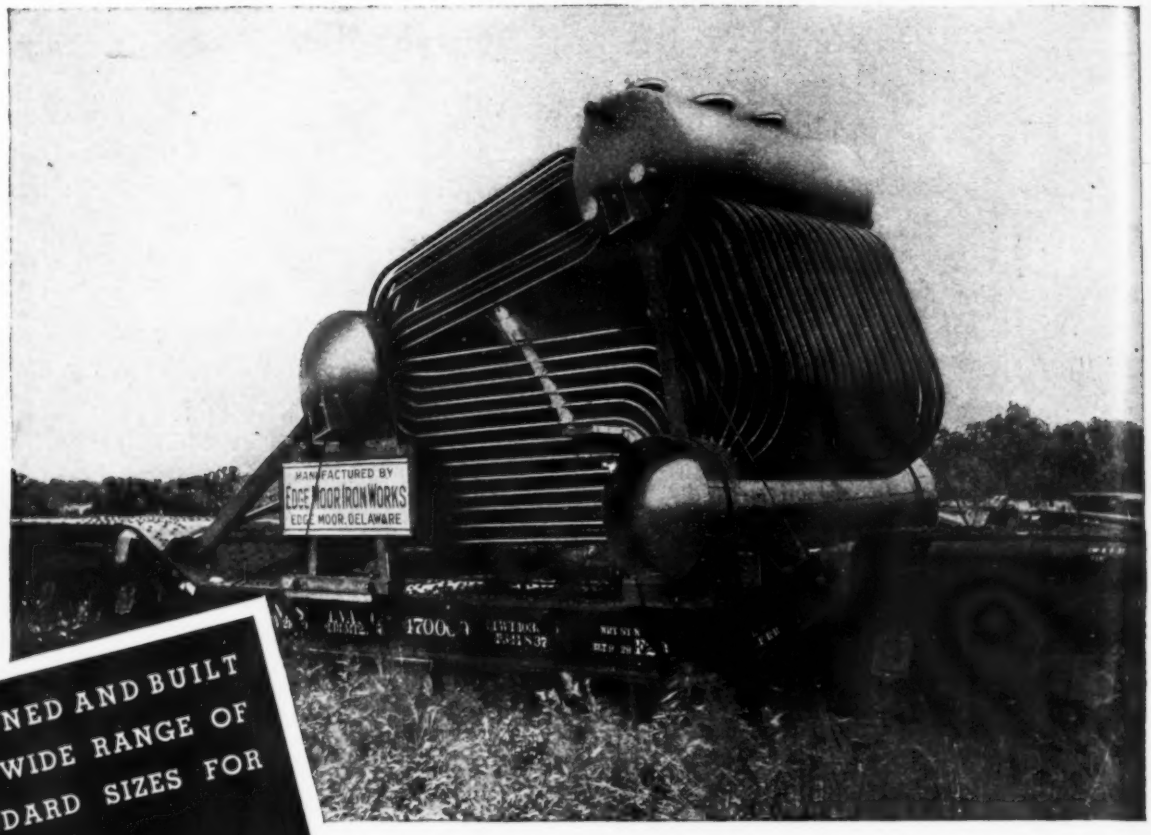
As no extra metal is added in the welding process, the grain structure of wall and weld is homogeneous. Physical properties are further improved by atmospheric annealing; this also produces a scale-free, bright finish which hides no defects on either inside or outside surface. Maximum strength of Talon's Electric Welded Steel Tubing is assured by hydrostatically testing every foot of pressure tubing for safety and by carefully inspecting mechanical tubing to meet your own individual requirements. Hence, Talon's Electric Welded Tubing meets A. S. M. E., S. A. E., A. S. T. M., A. B. S. and all standard government specifications.



TALON . . INC.

STEEL TUBE DIVISION **OIL CITY, PENNA.**

EDGE MOOR LOW HEAD WATER TUBE BOILER



DESIGNED AND BUILT IN A WIDE RANGE OF STANDARD SIZES FOR

Hospitals	Textile Mills
Post Offices	Warehouses
Packing Plants	Colleges
Dairies	Railroads
Laundries	Potteries
Arsenals	Hotels
Office Buildings	Drug Mills
Canning Plants	Distilleries
Machine Shops	Breweries
Brick Plants	Paint Plants

COMPLETELY ENGINEERED

. . . shipped ready for quick, economical installation

To meet the growing needs for moderate capacity units, Edge Moor offers 3-Drum Low Head Boilers designed for use with any type of fuel or burning equipment. Capacities range from 100 to 600 HP at 125 to 600 lbs. pressure. Every feature of design and construction has been proven practical in many installations . . . Rapid production of dry steam is assured . . . 3¼" O.D. tubes are standard on all types, providing full accessibility to cleaning tools . . . Any tube may be replaced without distributing other tubes . . . These units can be readily equipped with superheaters, air preheaters, economizers, water walls and soot blowers . . . Standardized design insures prompt delivery. Where railroad clearance permits, substantial savings of both time and money can be effected by complete shop assembly. Write for Bulletin No. 105.

STANDARD EQUIPMENT INCLUDES:

WELDED DRUMS—Edge Moor built. X-rayed and stress relieved.

BAFFLES—Monolithic or built-up tile construction, arranged to suit firing equipment

TUBES—3¼" O.D. formed well within A.S.M.E. tolerances on Edge Moor tube bending equipment.

STEEL—All structural steel for supporting boiler entirely independent of brickwork.

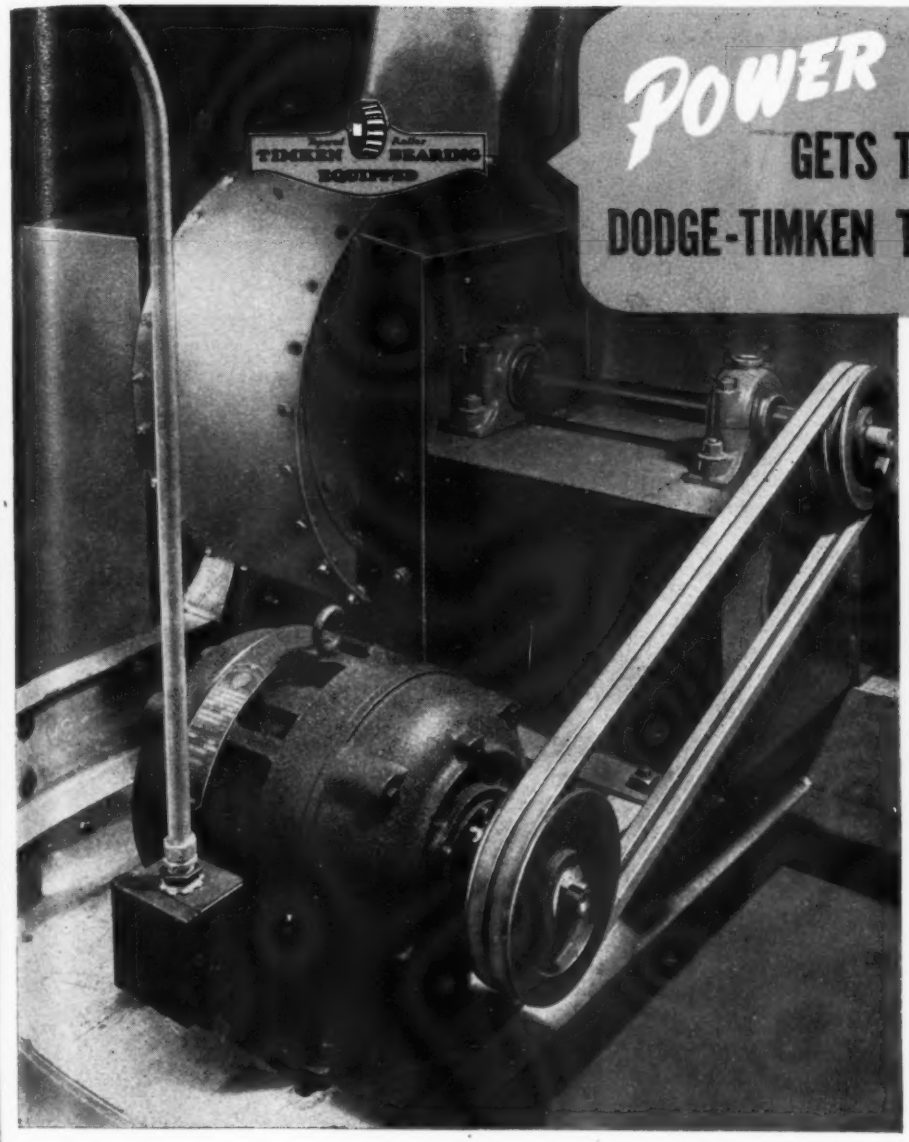
ACCESS DOORS—Three 15" x 18" C.I. machined doors; one 8" x 30" tube removal door.

EQUIPMENT—Complete Damper, box and operating lever . . . A.S.M.E. Safety Valves . . . Steam Gauges . . . Blow-off Valves . . . Feed Stop and Check Valves . . . Water Column with alarm . . . all necessary piping.

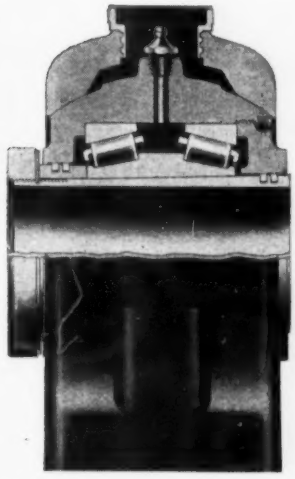
EDGE MOOR IRON WORKS, INC.

EDGE MOOR, DELAWARE

NEW YORK CITY: 30 ROCKEFELLER PLAZA • CHICAGO: ONE NORTH LA SALLE STREET



POWER GETS THE RIGHT OF WAY IN DODGE-TIMKEN TRANSMISSION UNITS



Dodge-Timken Double Interlock Pillow Blocks and D-V Drive on core oven plant.

Wherever power passes through modern Timken Bearing Equipped transmission units, it passes freely and without loss —unchallenged by friction that exacts such a heavy toll in obsolete, worn-out line shaft hangers, pillow blocks and other power transmission equipment.

Timken Tapered Roller Bearings not only save power; they save lubricant also because they can be sealed so effectively—keeping lubricant in, dirt out. Furthermore, this prevents damage to the product through oil contamination—a very important consideration in many plants.

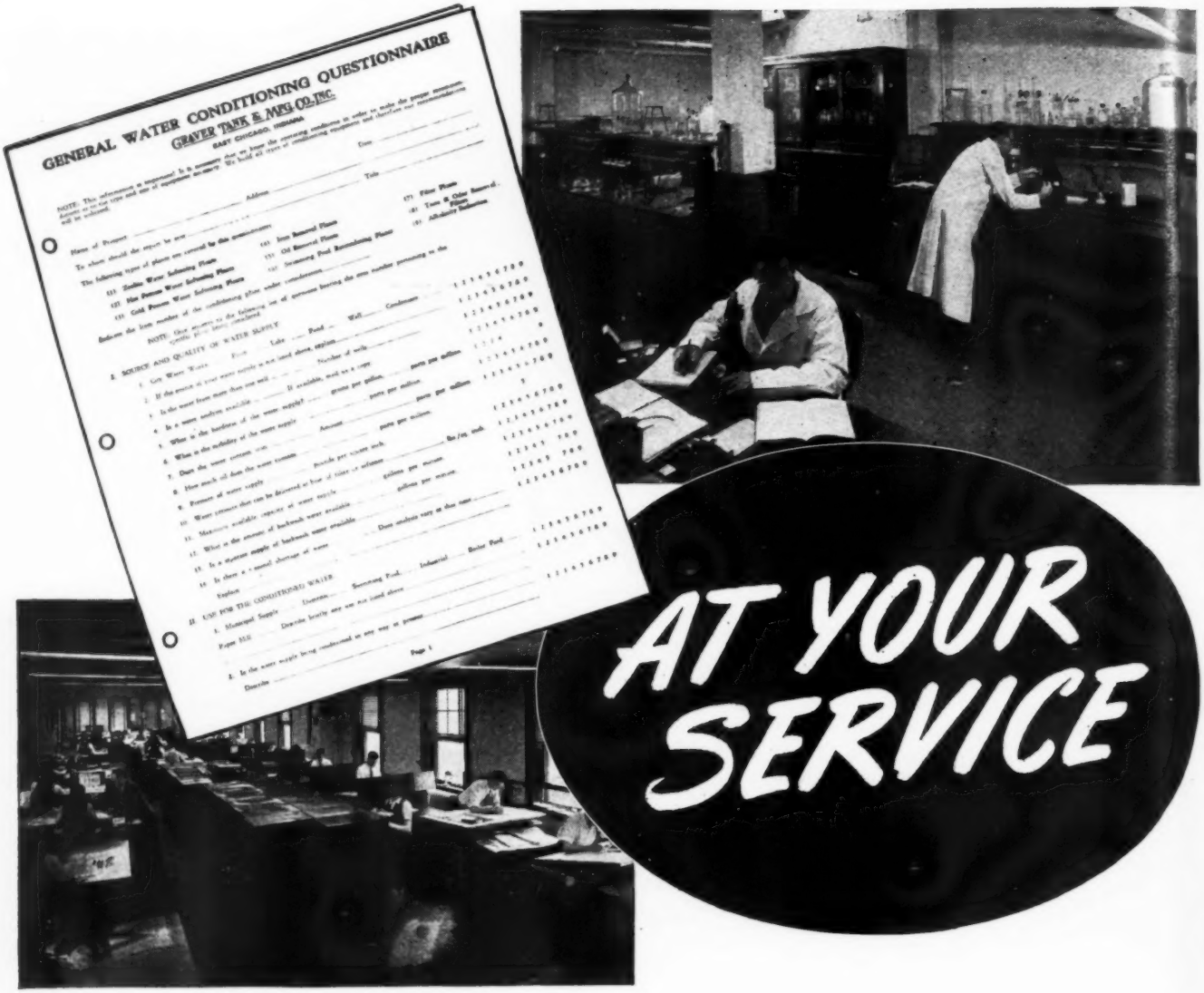
Remember, you pay the same for power whether it is *used* or *wasted.* Is your transmission equipment *modern,* therefore *economical?* Check up now and replace if necessary. The Timken Roller Bearing Company, Canton, Ohio.

Are you prepared to meet the challenge of post-victory competition? If not, prepare now; redesign your equipment to use more Timken Bearings.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



. . . our experience and laboratory facilities

Is your water conditioning equipment delivering the quality of water you must have?

Is its capacity sufficient for your requirements?

Are you satisfied with its operating cost . . . its efficiency?

If you are confronted with any such problems, or if you are planning the installation of additional equipment for any phase of water conditioning, we shall be glad to give you the benefit of our more than thirty years of experience without obligation.

We have prepared an exceptionally complete and comprehensive questionnaire which will enable you to give us full information about your present equipment and your requirements. This information, together with a sample of the water to be treated, will enable us to analyze your problem and submit unbiased recommendations.

Write today for a copy of this special questionnaire. There's no cost or obligation.

GRAVER TANK & MFG. CO., INC.
4809-25 Tod Ave., East Chicago, Ind.
NEW YORK CATASAUQUA, PA. CHICAGO TULSA

GRAVER *Water Conditioning Equipment*

43-34-W

To keep control costs DOWN KEEP UP WITH McALEAR

Precision Controls for Regulating...

PRESSURE

FLOW and LIQUID LEVEL

TEMPERATURE

HOW TO USE McALEAR SERVICE

Look to McAlear for leadership and pioneering in the field of pressure valves and fluid transport controls. For precision engineered control devices that reduce down-time . . . and hold maintenance expense to an absolute minimum.

McAlear has never shied away from specification jobs requiring research and development. Nor do we even today. We continue to seek opportunities to design and develop special controls for specific applications.

If you have a control problem call on McAlear engineers. Draw on their fund of experience, on their ability and readiness to help you, whether for wartime application or post war planning. For informative bulletins and catalog, write McAlear Manufacturing Company, 1913 S. Western Ave., Chicago.

McALEAR

PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

controls

for STEAM. WATER. AIR. OIL AND GAS

WeldELLS have everything

"Sometimes I think Taylor Forge had me in mind!"

IN this purchasing job a fellow is always in the middle with pressure groups on all sides. So you can sure breathe a sigh of relief when you come across a product like WeldELLS* that pleases them all down the line!

Take the men who give first importance to engineering considerations: They like the reinforcement of the inner wall and they like the tangents that keep the welds away from the zone of greatest stress.

And then take the fellows who do the welding: They go for the practical features that make WeldELLS easy to work with — the quarter-markings; the clean bevels and lands; the tangents. They're strong for that Taylor Forge method of permanently marking the size and weight on every fitting, too.

Of course fittings that get the vote of both the engineer and the man on the job give us the best piping job and keep costs down. So you might know that makes WeldELLS ace high with the man who keeps the score and pays the bills.

Sometimes I think Taylor Forge had purchasing agents in mind when they gave their welding fitting *everything* . . . . for everybody!

★ No other fittings for pipe welding combine these features found in WeldELLS:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends** — simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking** — saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provide best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

● The list of Taylor Forge's contributions to the war effort only begins with WeldELLS. One of many examples is Taylor Corrugated Marine Furnaces, essential to many merchant ships and transports.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
NEW YORK OFFICE: 50 CHURCH ST. • PHILADELPHIA OFFICE: BROAD ST. STATION BUILDING

*WeldELLS and many other Taylor Forge products are produced in Byers Genuine Wrought Iron.

A pair of pants is not as hard to replace as vital motor parts—but in either case, you're more interested in protection than in replacement. Macmillan RING-FREE Motor Oil *protects* pistons... rings... valves... bearings because it reduces friction faster!

Reduced fuel consumption is proof of friction Reduction!

If friction is reduced, more horsepower is released to the drive-shaft—and this extra horsepower should be measureable in reduced fuel consumption. Compare RING-FREE with *any* other motor oil on that basis under similar conditions!

RING-FREE removes carbon

Carbon removal is a natural RING-FREE function, inherent in the crude oil and retained by the exclusive Macmillan patented process. RING-FREE removes carbon while the motor runs!

In 1094 certified road tests, with various makes of owner-driven cars, the average *immediate* saving of gasoline was 1.3 miles per gallon after crankcases were drained and refilled with RING-FREE. In many types of Diesel operations, as much as 25% reduction in operating costs (including maintenance and fuel) are reported. At the same time, oil consumption is reported decreased!

Macmillan RING-FREE Motor Oil combines all these qualities: 1—Removes Carbon, 2—Reduces Friction *Fast*, 3—Saves Fuel, 4—Has Great Film Strength, 5—Has High Heat Resistance, 6—Long Cling to Metal, 7—Fast Penetration, 8—Is Non-Corrosive, 9—Is Less Affected by Dilution.

Macmillan Petroleum Corp.

50 W. 50th, New York • 624 S. Michigan Ave., Chicago • 530 W. 6th, Los Angeles

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MACMILLAN RING-FREE MOTOR OIL

REG U. S. PATENT OFFICE

REDUCES WEAR BY REDUCING FRICTION

TERRY

ROTOR AND BUCKETS ALL IN ONE PIECE

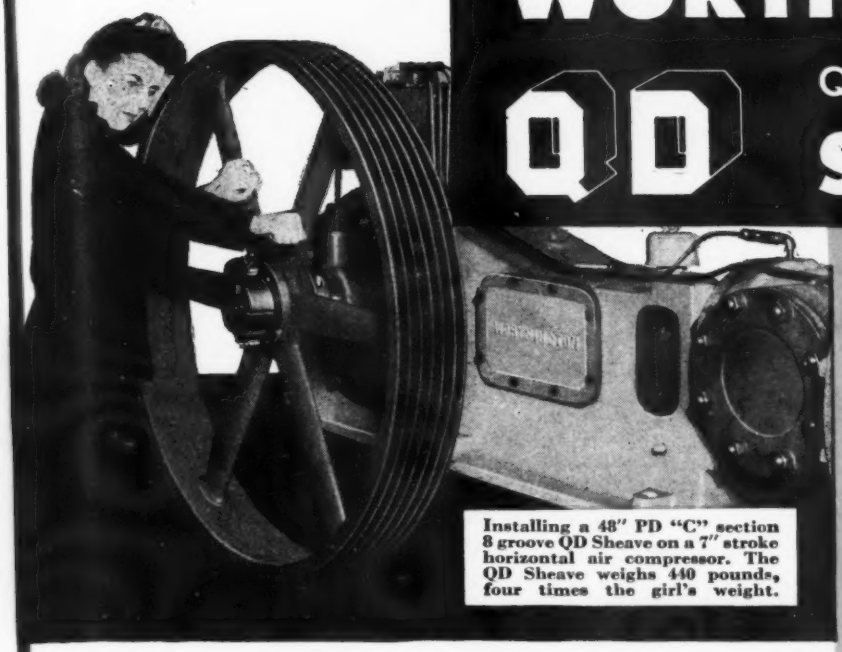
In the Terry Turbine the wheel is made from a single forging of special composition steel. The buckets are milled directly in the wheel, there are no parts to become loose or work out, such construction makes for long life and low maintenance.

This and many other features of Terry Wheel Turbine design are described in our Bulletin S-116. A request on your business letterhead will bring a copy.

T-1138

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

WORTHINGTON QD QUICK DETACHABLE SHEAVES



Installing a 48" PD "C" section 8 groove QD Sheave on a 7" stroke horizontal air compressor. The QD Sheave weighs 440 pounds, four times the girl's weight.

NOW AVAILABLE for DriveN as well as DriveR applications

Women assembling GIANT DRIVEN SHEAVES, no longer are an oddity to be headlined in Ripley's "Believe It Or Not." INEXPERIENCED "GREEN" HELP in assembly plants find these sheaves simple to mount.

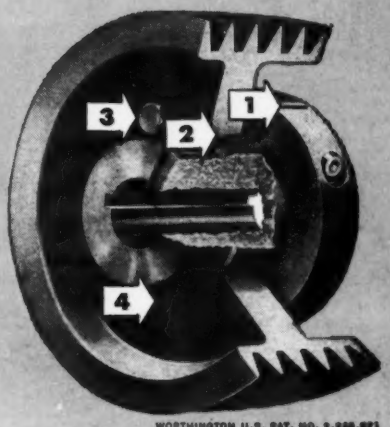
The problems of assembling and maintaining Vital DriveN and DriveR machinery have been greatly simplified with the introduction of the Worthington patented QD Sheave with its "Easy To Get On—Easy To Get Off, YET ALWAYS TIGHT ON THE SHAFT" features.

The QD Sheave design has now been incorporated into a complete range of DriveN and DriveR sizes that will accommodate 10,000 drive combinations up to 150 horsepower from stock.

One demonstration will convince you that a wrench and inexperienced hands are all that are needed to install or remove a QD Sheave, regardless of size. Arrange for your demonstration today—write or call the Worthington Multi-V-Drive dealer or the Worthington District Office in your territory.

3-10

Superior Advantages of the QD Sheave Design Cost No More



WORTHINGTON U.S. PAT. NO. 2,288,821

1 **Split Hub** for easy mounting or removal from the shaft.

2 **Tapered Fit** between split hub and rim for easy mounting or removal of rim from hub.

3 **Pull-up Bolts** which hold the rim onto tapered split hub for tapered friction drive assembly and positive press fit on the shaft.

4 **Tapped holes** in rim for using pull-up bolts as jack screws to free the tapered friction fit when detaching the rim.

Mail the Coupon NOW for this New Bulletin

I would like more information about the Time, Labor, and Material Saving Advantages of the Worthington QD Sheave.

Name Title

Company

Address

City State County

Product Manufactured

WORTHINGTON MULTI-V-DRIVES

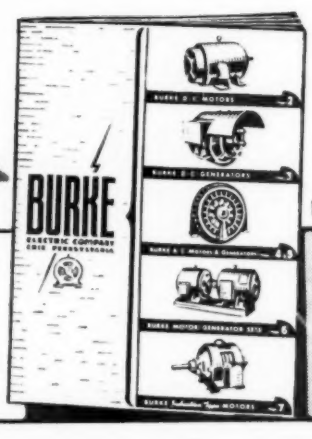
COMPLETE DRIVES — SHEAVES OR BELTS ONLY

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

What can BURKE do for Me?

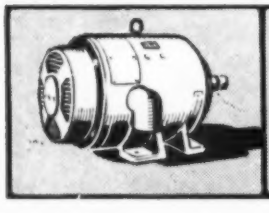
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer

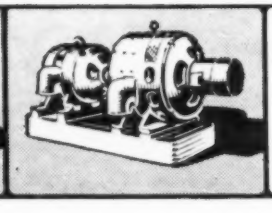
You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.



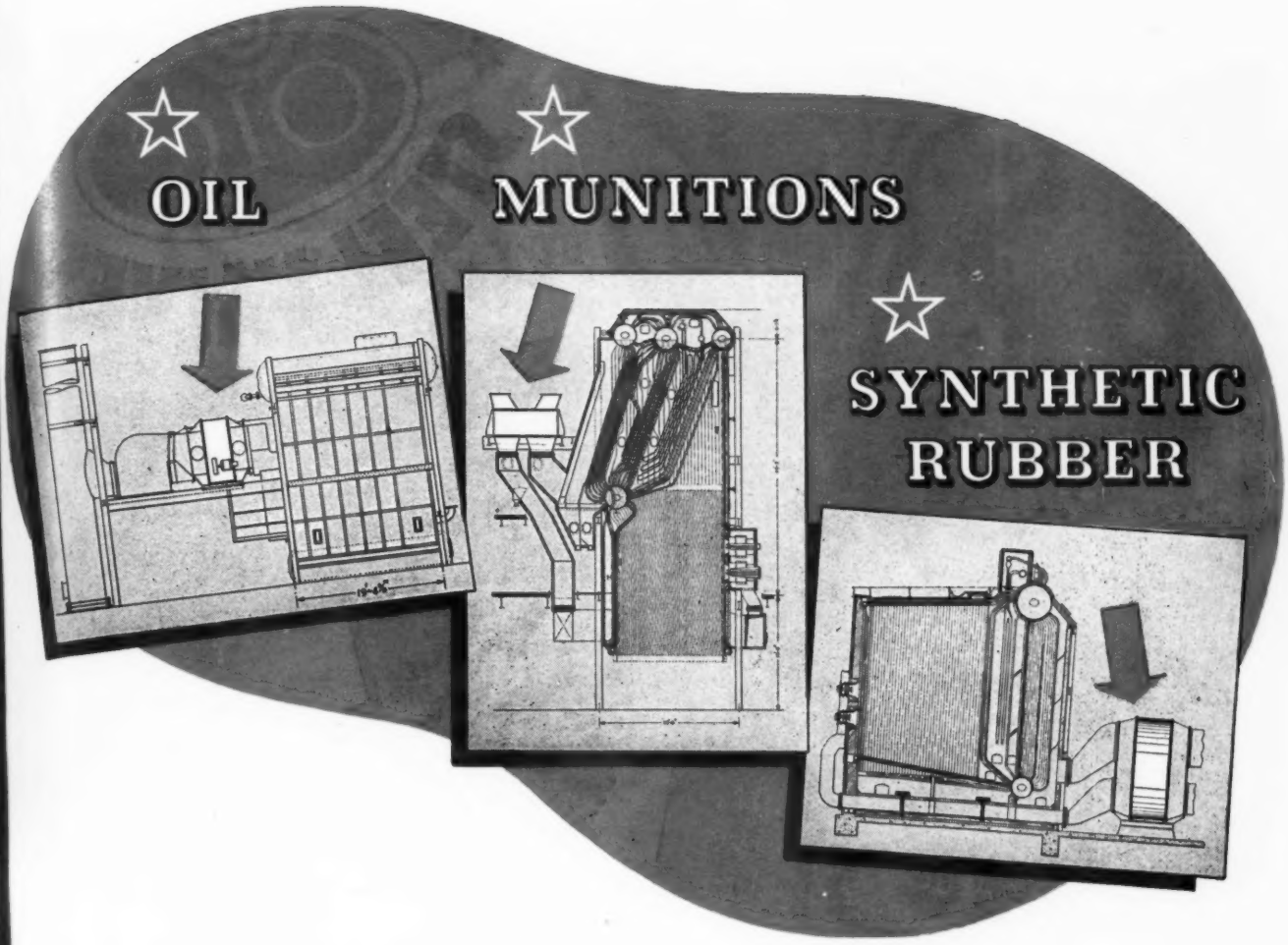
⇨ ⇨ *For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog*

BURKE ELECTRIC COMPANY • 1201 WEST 12TH STREET ERIE, PENNSYLVANIA





D. C. Equipment to 1500 H. P. and 1000 K. W.
A. C. Equipment to 1500 H. P. and 1000 K. W.
M-G Sets to 1000 K. W.
Molded Bakelite Terminal Blocks



Vital war plants boost heat-recovery, save fuel, with Ljungstrom Air Preheaters

PROCESS industries at the heart of the war program are powered by Ljungstrom-equipped boiler plants. The reason? The Ljungstrom Air Preheater combines high operating continuity *with maximum conservation of fuel and steel.*

• • • • •

With preheated air, combustion is more efficient, and poorer grades of fuel can be utilized. Waste-heat becomes an output booster.

In transferring heat from flue gases to incoming air, the Ljungstrom operates on a *continuous regenerative counterflow* principle that permits a reduction of ½ or more in the weight of heat transfer surface, compared to other types. Steel is saved, erection is simplified, and a higher heat-recovery level becomes practical despite today's limitations on construction materials.

In addition, the Ljungstrom has established high records for continuity of service, and normal maintenance is quickly and easily carried out. Gas temperatures as high as 1600°F are being successfully handled in installations in the process industries.

If you have a problem involving gas-to-air heat transfer, why not ask our engineers for application aid. On boiler plants, all major builders are prepared to incorporate the Ljungstrom in their designs.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

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STEEL VALVES
OIC Cast Steel Valves . . . Gates . . . Globes . . . Angles . . . Checks . . . are ready and qualified to do just the job you need done.
Literature is available, showing the exclusive OIC features of design and construction.
There is an OIC Distributor near you. Call him, or write us for complete information.
6
150
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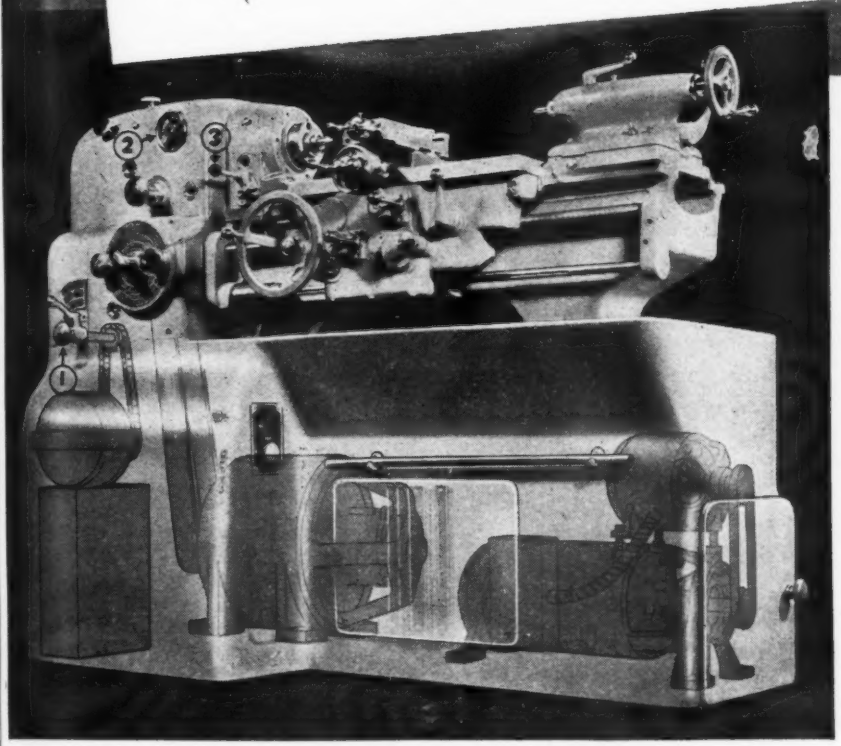
THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO
Quality Leaders in Valve Manufacture Since 1883

Now you can have your machine tools designed the way you've always wanted them!

RELIANCE V★S DRIVE

A BUILT-IN ALL-ELECTRIC DRIVE FOR A-C CIRCUITS

eliminates gears, brakes and clutches



Precision Lathe with Built-In Reliance V★S Drive

FOR EXAMPLE, the designers of this all-electric precision lathe made full use of the Reliance V★S Drive. They offer:

> A lathe giving spindle speeds from 5 to 2500 rpm. with but one gear change . . . All electrical equipment is built-in and arranged for connection to an a-c. circuit . . . Speed changes at the turn of a handle (1) . . . Spindle speeds indicated by tachometer (2) . . . Spindle operation (starting, stopping, reversing), all controlled through the motor by a small switch on the headstock (3).

The Reliance V★S Drive is more than a source of power. In machine tools, it provides speed control for spindle or table and for feed drives. It replaces change gears, reversing gears, brakes and clutches—not only in machine tools, but in many other motor-drive applications.

You, too, may find in Reliance V★S Drive the *new* design opportunities you have been looking for. Call in a Reliance Application Engineer or write for Bulletin 311.

RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 Ivanhoe Road • Cleveland, Ohio

BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE (S. C.) • LOS ANGELES • NEW YORK • PITTSBURGH
PHILADELPHIA • PORTLAND (ORE.) • ST. LOUIS • SALT LAKE CITY • SAN FRANCISCO • SYRACUSE AND OTHER PRINCIPAL CITIES

HELPING to ESTABLISH *NEW "HIGHS"* *In Kilowatt Output*

With kilowatt production for 1943 outstripping all previous records, America's power plants continue to play their vitally important, increasingly successful role in the nation's war effort.

The industry's achievement is especially remarkable in view of the wartime limitations on new equipment. For most plants, the problem was that of substantially increasing kilowatt output with *existing equipment*—and one big factor in its solution has been *more adequate heat insulation.*

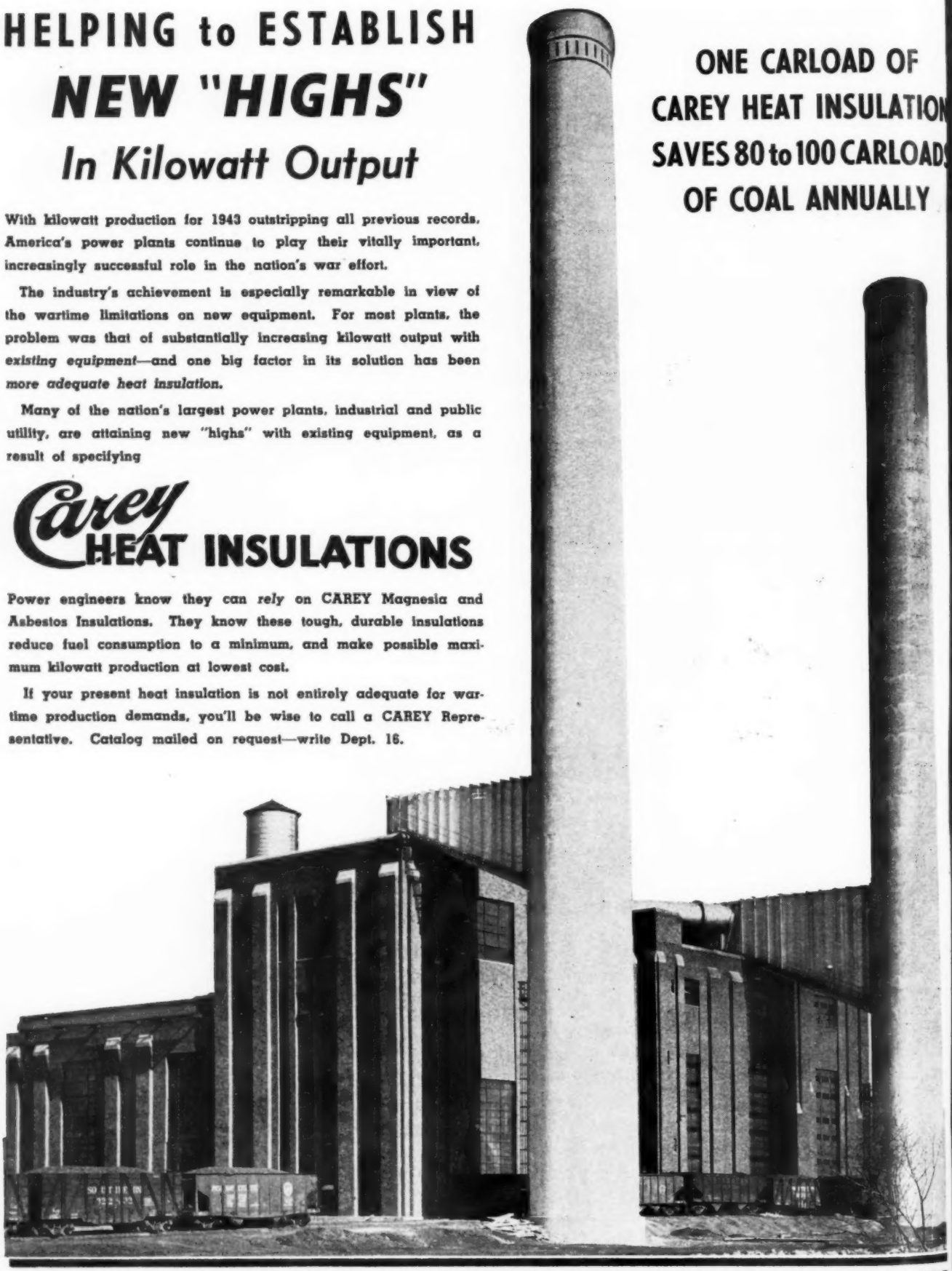
Many of the nation's largest power plants, industrial and public utility, are attaining new "highs" with existing equipment, as a result of specifying

Carey HEAT INSULATIONS

Power engineers know they can *rely* on CAREY Magnesia and Asbestos Insulations. They know these tough, durable insulations reduce fuel consumption to a minimum, and make possible maximum kilowatt production at lowest cost.

If your present heat insulation is not entirely adequate for wartime production demands, you'll be wise to call a CAREY Representative. Catalog mailed on request—write Dept. 16.

ONE CARLOAD OF CAREY HEAT INSULATION SAVES 80 to 100 CARLOADS OF COAL ANNUALLY



THE PHILIP CAREY MANUFACTURING COMPANY

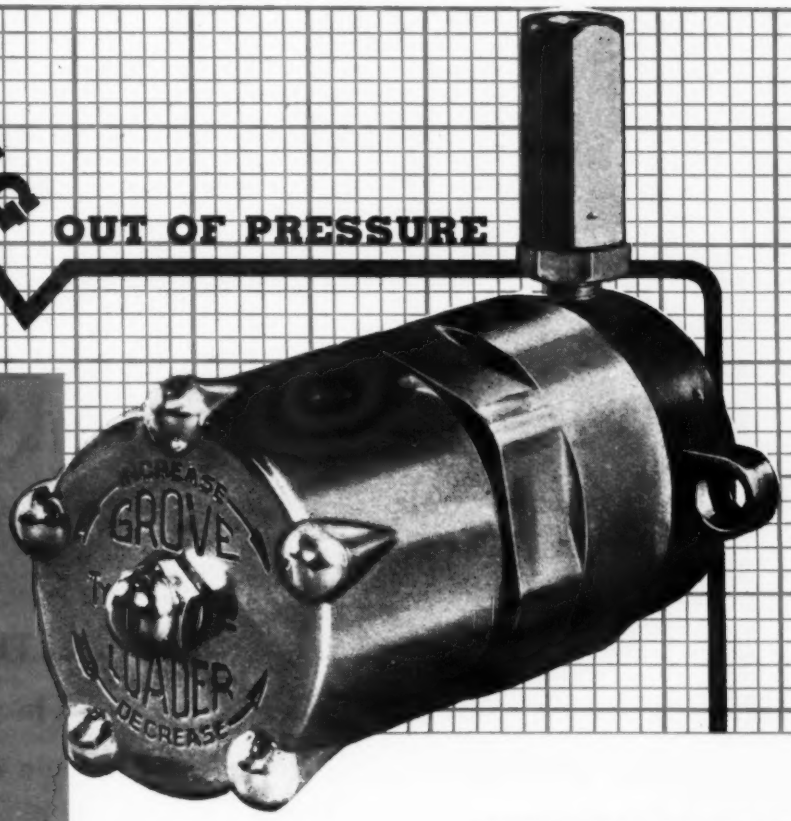
Dependable Products Since 1873 • Lockland, Cincinnati, Ohio

In Canada: The Philip Carey Co., Ltd. Office and Factory: Lennoxville, P. Q.

TAKE THE ZIG ZAG OUT OF PRESSURE

WITH

GROVE *Automatic* PRESSURE REGULATING VALVES



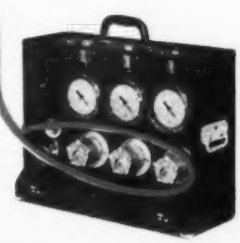
EXTREMELY ACCURATE
SMALL CAPACITY HIGH PRESSURE REGULATOR

SUITED TO MANY USES:

1. *Remote Pressure Control to Power Cylinders and Motor Valves*
2. *Maintaining Gas Pressures on Liquid Containers*
3. *Control Fluid Seals on Stuffing Boxes, Vacuum Systems*
4. *Controlling Pilot Flames, Testing Apparatus*
5. *Controlling Hydraulic Pressures, Testing and Process Presses*
6. *Maintaining Constant Pressures, Reaction Vessels*
7. *Holding Back Pressure, Experimental Process Systems*
8. *Controlling Flow Rates in Blending Operations*
9. *Controlling CO_2, Nitrogen, Hydrogen at High Pressure*
10. *Maintaining Lubricating Oil Pressure, Machine Bearings*
11. *Safety Shut Off, Small Volume Flow Lines*
12. *Remote Manual Pressure Control Stations Operating in Combination with Grove Reducing Valves*

The GROVE DOME LOADER, originally designed for use with Grove High Pressure Powreactor Dome Regulators which operate on the Pressure-balance principle can be employed in many other industrial applications. It is a spring and diaphragm operated small capacity high pressure regulator within itself. It makes possible a smooth manual remote control of pressure in a closed vessel, providing the necessary automatic operation to maintain this pressure even though pressure changes occur due to variations in temperature. Ideal for use in laboratories and as a reducing pilot.
Write for complete details today.

THE SAME UNIT AROUND WHICH GROVE PNEUMATIC GAUGE COMPARATOR IS DESIGNED AND BUILT...
The Grove Dome Loader is the basis of this fine precision-built testing instrument which is employed for accurately checking Pressure Gauges without removing them from panels or mountings. Bulletins available.



WRITE TODAY FOR GROVE LOADER BULLETIN—Outlining Your Specific Requirements

GROVE *Pressure Control* EQUIPMENT

GROVE SIMPLICITY ACCURACY SAFETY

GROVE REGULATOR COMPANY
1197 67TH STREET, OAKLAND CALIFORNIA
BRANCH OFFICES: 5644 NAVIGATION BLVD., HOUSTON, TEXAS • 30 ROCKEFELLER PLAZA, NEW YORK CITY, N. Y.

WHAT IS MACHINERY'S No. 1 ESSENTIAL?

. . IT'S LUBRICATION OF THE RIGHT KIND that will keep production machines in good operating condition and continuously on the job. Idle machines due to worn bearings, gears or chains, caused by improper lubrications are certainly on the blacklist these days . . . and remember that machine replacement parts are most difficult to get. Yes—the No. 1 essential today is proper lubrication.

★ ★

7 QUICK FACTS ABOUT LUBRIPLATE LUBRICANTS

1. *LUBRIPLATE produces an ultra-smooth, wear-resisting bearing surface.*
2. *LUBRIPLATE reduces friction, thus lowering maintenance and power costs.*
3. *LUBRIPLATE resists rust, corrosion and pitting.*
4. *Most LUBRIPLATE products are white. LUBRIPLATE assures clean lubrication.*
5. *LUBRIPLATE outlasts ordinary lubricants many times.*
6. *LUBRIPLATE is economical—a little goes a long way.*
7. *LUBRIPLATE is available in fluid and grease types for every need.*

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING COMPANY
SINCE 1870
Newark, N. J. Toledo, Ohio
DEALERS FROM COAST TO COAST

LUBRIPLATE

THE MODERN LUBRICANT *that Arrests Progressive wear*

"Its the Film"

Climax Diesels

Climax Announces a New Line of Solid Injection, Compression Ignition Engines

● To meet the increasing demands for low cost packaged power, mechanical or electrical, Climax Engineering Company announces a new line of solid injection, compression ignition engines.

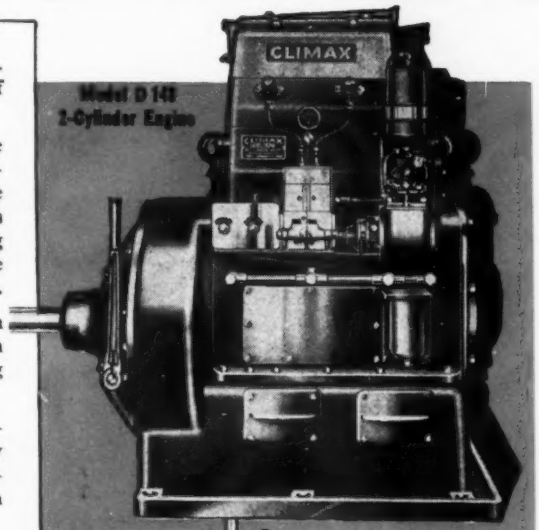
These power units supplement the Company's line of well-known Blue Streak Gas Engines, used extensively in the power, engineering construction, mining and oil industries. From the time the company built the first successful gasoline engine for heavy duty cranes, Climax Engines have earned an excellent reputation for dependability with extremely long life. Some of these engines, made 30 years ago, are still in service. We have no doubt that the New Climax Diesels will earn a similar good name.

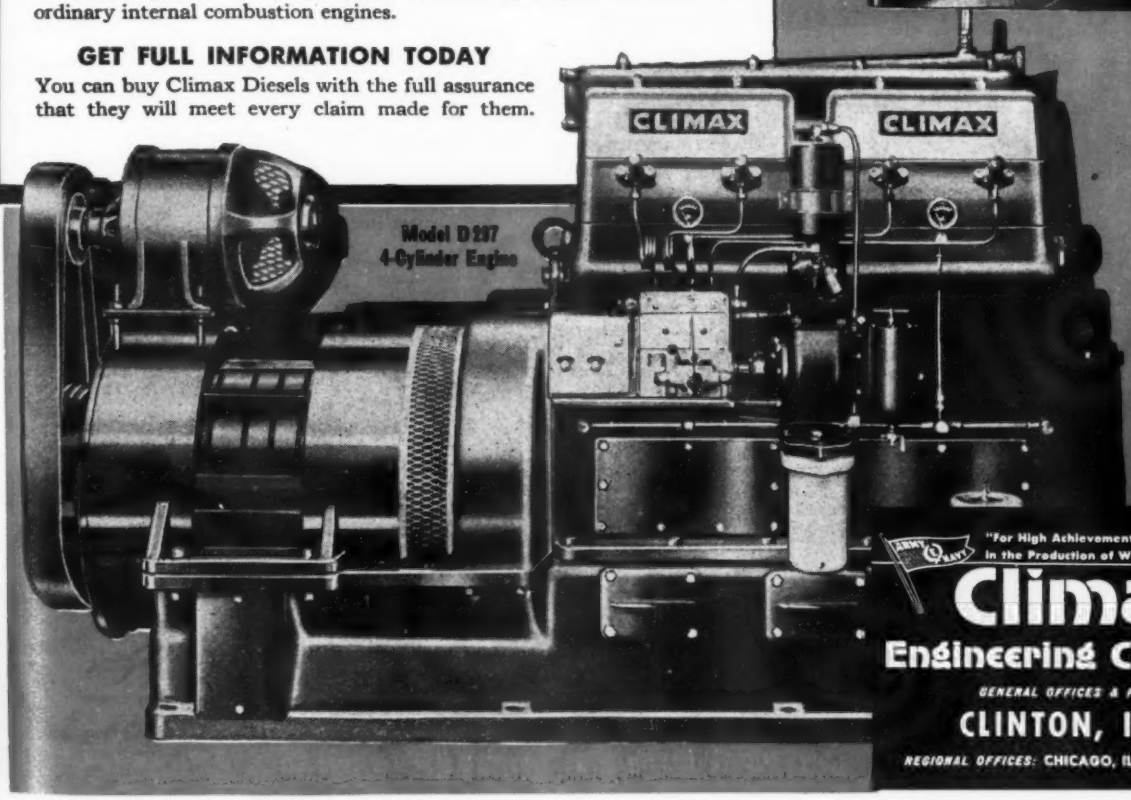
At present, two Diesel engines are in production. Model D148 is a 2-cylinder unit with a maximum rating of 22 hp. and will drive a 15 kva generator. Model D297 is a 4-cylinder engine with a maximum rating of 44 hp. and may be used to power a 30 kva generator.

Both engines are 4-cycle, full Diesels which operate reliably and efficiently on low grade fuel oil or refined crude. They are simply designed, easy to understand and run with a negligible amount of inspection and maintenance. Adjustments or repairs can be made by anyone familiar with ordinary internal combustion engines.

GET FULL INFORMATION TODAY

You can buy Climax Diesels with the full assurance that they will meet every claim made for them.





"For High Achievement in the Production of War Material"

Climax Engineering Company

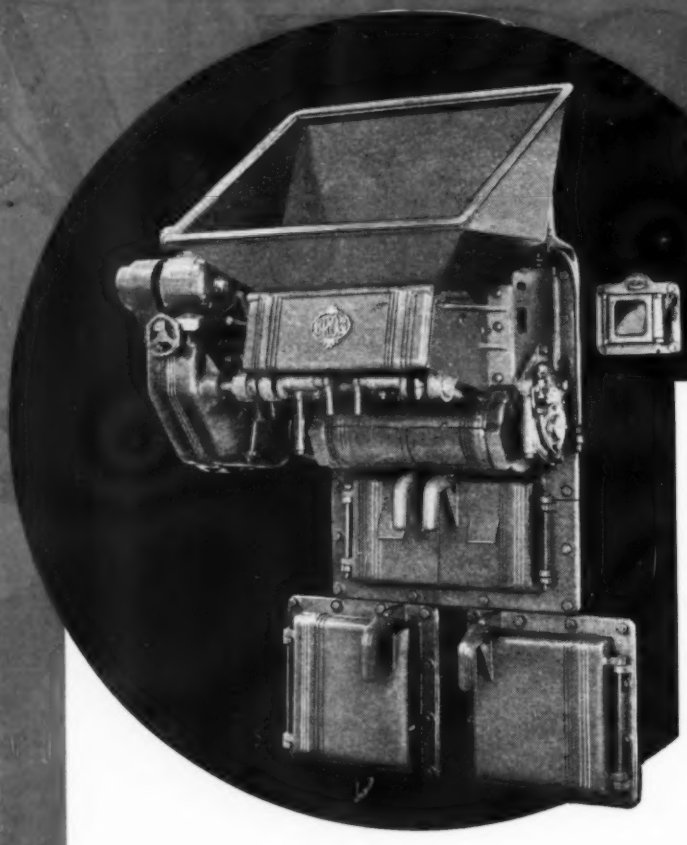
GENERAL OFFICES & FACTORY:

CLINTON, IOWA

REGIONAL OFFICES: CHICAGO, ILL., DALLAS, TEXAS

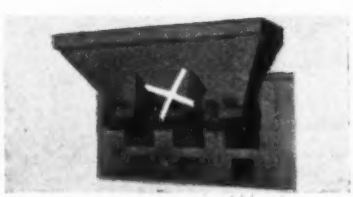
Solves

TODAY GREATER



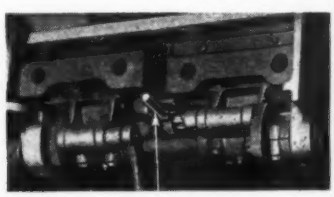
Engineered for

● Bros Spreader Stokers can help you solve your firing problems now and for years to come. They bring to your operations many distinct advantages. First they help you solve the question of fuel. If the shortage of oil or gas is a problem you can convert to coal. And since the Bros Spreader Stoker



Unit Drive — Individual stoker may be stopped for cleaning, dumping or repairs without interrupting operation of balance of stokers. ½ H. P. motor.

Single Feeder Shoe — Full width of machine, for boilers requiring two or more stokers with separate grate sections, dumping facilities and forced draft.



Double Feeder Shoe—Each shoe may be operated independently. Coal may be fed to one side of divided grate while other side is being cleaned. All the benefits of 2 stokers.

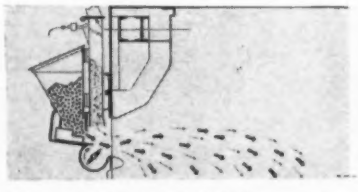
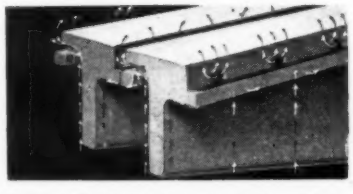
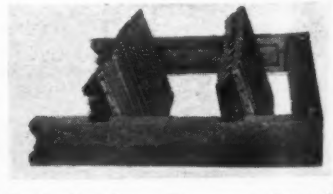


Diagram of Dual-Fuel Firing — Refuse flows directly onto rotor. Coal feed is still automatically controlled according to steam load requirements.



Tuyere Design (Cross Section) — Large heat-dissipating area. No vertical jet action to create fly ash. Air evenly distributed to grate maintains uniform, thin fuel bed.



Grate Section—Cut-away model of 16" grate in dump position with clearance of 10½" between grate sections. Unbalanced construction insures tight tuyere closings.

Fuel Oil Conversion
QUICKLY - ECONOMICALLY

Conversion from oil to coal firing can be easily, quickly and inexpensively accomplished with Bros Spreader Stokers. Large stock carried in Minneapolis. Write nearest representative for information.

Resident Representatives serving all markets.

BROS

every firing need—

AND TOMORROW...WITH EFFICIENCY AND ECONOMY!

Dependability in Every Firing Requirement!

burns any kind and size coal that will go through a 3" screen and burns it efficiently, it makes available for your use any type of hard fuel mined or shipped into your locality. If you have factory waste that is combustible, Bros Spreader Stokers may be adapted to utilize it in combination with coal at high efficiencies.

If you need more capacity from your boilers, Bros Spreader Stokers will help you get that capacity. If you're still employing hand firing and labor is a problem, Bros Spreader Stokers can simplify that job because they're automatic.

Bros Spreader Stokers give you many other advantages.

They operate at high efficiencies whether the load is a heavy continuous one or widely fluctuating . . . *Bros Spreader Stokers follow the load.* The thin, evenly distributed fuel bed carried on the grates responds more readily to changing demands than the thick, sluggish fuel beds associated with other types of mechanical firing. There are no banking losses and no popping when the load falls off suddenly.

Efficiencies up to 80% are steadily maintained in ordinary boiler settings without special heat recovery equipment. Only a few minutes are required to run from a banked fire to 250% of rating. Tuyere-type Hulson grates, exclusive with Bros Spreader Stokers, and water-cooled stoker frame and bearings keep maintenance costs at the lowest possible figure. The average is less than ½ cent per ton of coal burned.

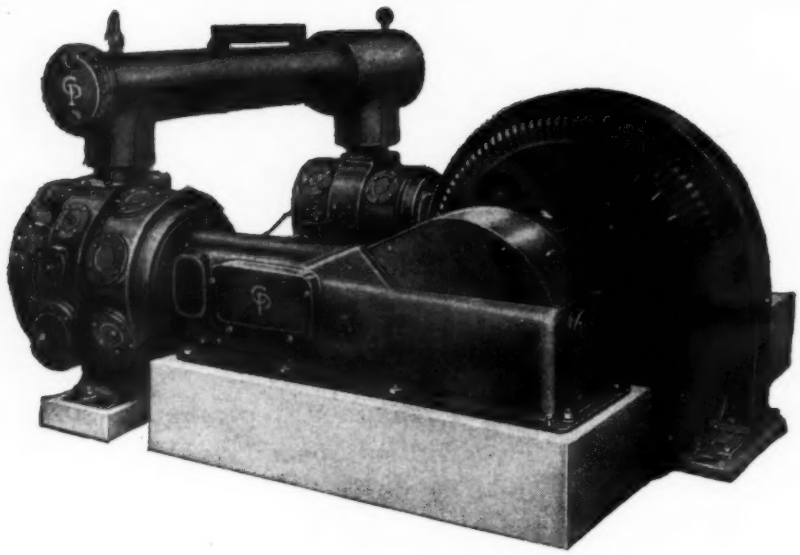
Bros representatives are strategically located to serve your needs. They can give you complete and immediate information and submit proposals.

WM. BROS BOILER & MFG. CO.
MINNEAPOLIS, MINNESOTA

Super-Spred STOKER

A Heavy Duty COMPRESSOR

FOR TWENTY-FOUR HOUR SERVICE



Available For Quick Deliveries

CP Class YCM package type compressor with built-in motor; sizes from 75 to 150 h.p.

Chicago Pneumatic Class O-CE compressors are built in a range of sizes . . . 75 to 1500 h.p. . . . in single or multi-stage designs . . . for pressures up to 5,000 pounds . . . for synchronous motor or "V" belt drive. Steam and Diesel engine types also available.

★★★★★★★★★

PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★

AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

$10,000.00 COMPETITION

FOR APARTMENT HEATING DESIGNS

MINNEAPOLIS-HONEYWELL *Offers*

2	CASH PRIZES OF	$2,000.00
2	CASH PRIZES OF	$1,000.00
2	CASH PRIZES OF	$500.00
20	CASH PRIZES OF	$150.00

for Winning Designs of a Hot Water or Steam System and its Controls for a Six Story Apartment Building, Giving Tenants Individual or

Personalized Heating Control

MINNEAPOLIS-HONEYWELL announces a $10,000 Competition for the design of a system of steam heating and its control, and a system of forced hot water heating and its control in a hypothetical six story apartment building.

Contestants will be furnished complete architectural drawings and layout sheets upon which to submit their designs. The purpose of the competition is to provide a design of a heating system which will incorporate greatest tenant health, comfort and convenience, reasonable first cost, low operating and maintenance cost and some form of Individual or Personalized Heating Control whereby tenants may have the exact temperature they desire in their own particular apartment. It is therefore necessary that contestants arrange their design of the heating system so that at least one thermostat be installed in each individual apartment.

Eligibility

Any persons in the United States, its dependencies, or Canada, who are not employees or representatives of the Minneapolis-Honeywell Regulator Company, their subsidiaries, their advertising agency or who are not judges of this competition, or who are not employees or representatives of any company deriving a substantial proportion of income from the sale of automatic controls, or who are not relatives of the aforementioned, are invited to compete.

GENERAL RULES

1. All entries must be postmarked not later than midnight, Nov. 15, 1943.
2. Only one layout of each type of heating system may be submitted by a contestant. He may choose either a hot water or steam system of heating, or both, but only one prize will be awarded to a contestant.
3. Detailed instructions with complete architectural layouts will be provided each entrant, together with informative booklet describing Personalized Apartment Heating Control.
4. Piping, radiation or boiler need not be sized, but material used and piping layout are to be considered of major importance, particularly in regard to economy.
5. Entries will be judged on the basis of design merit only and not upon the manner of presentation. Elaborate details or ornamentation are discouraged.
6. It is not necessary to indicate equipment on the layout by manufacturers' trade name or type number. The general name applying to the piece of equipment shown need only be used.
7. All entries will be judged anonymously by a jury consisting of a nationally recognized consulting engineer, a nationally recognized architect and a representative of Minneapolis-Honeywell.
8. Minneapolis-Honeywell Regulator Company reserves the right to reproduce in brochure or other form, any or all of the layout entries submitted in this competition. All entries shall become the property of Minneapolis-Honeywell Regulator Company.

MINNEAPOLIS *Honeywell*

TEMPERATURE CONTROLS

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2702 Fourth Avenue South • Minneapolis, Minnesota

Please send me entry form and complete architectural layout sheets for your $10,000.00 Personalized Apartment Heating Design competition.

Name.....

Firm.....

Address.....

City.....State.....

ALWAYS
READY FOR USE

*THE NEW "MEGGER"**
INSULATION TESTER . . .

a worthy addition to the famous "MEGGER" family!

MADE IN U.S.A.

- HAND-CRANKED GENERATOR
- DIRECT-READING OHMMETER
- SIMPLE
- RUGGED
- RELIABLE

*Trade Mark Reg. U. S. Pat. Off.

With our Philadelphia factory now in full production, your needs for "Megger" Insulation Testers can soon be met.

Our new U. S. models are of the same general design and are similar in every way to our well-known "Meg" and "Super-Meg" Insulation Testers, except that they are housed in plastic molded cases instead of aluminum. All internal parts are made to the same proven design and specifications as the "Meg" instruments,—without compromise or substitution of materials. The cases are of high impact strength plastic,—one of the strongest, toughest molding materials available.

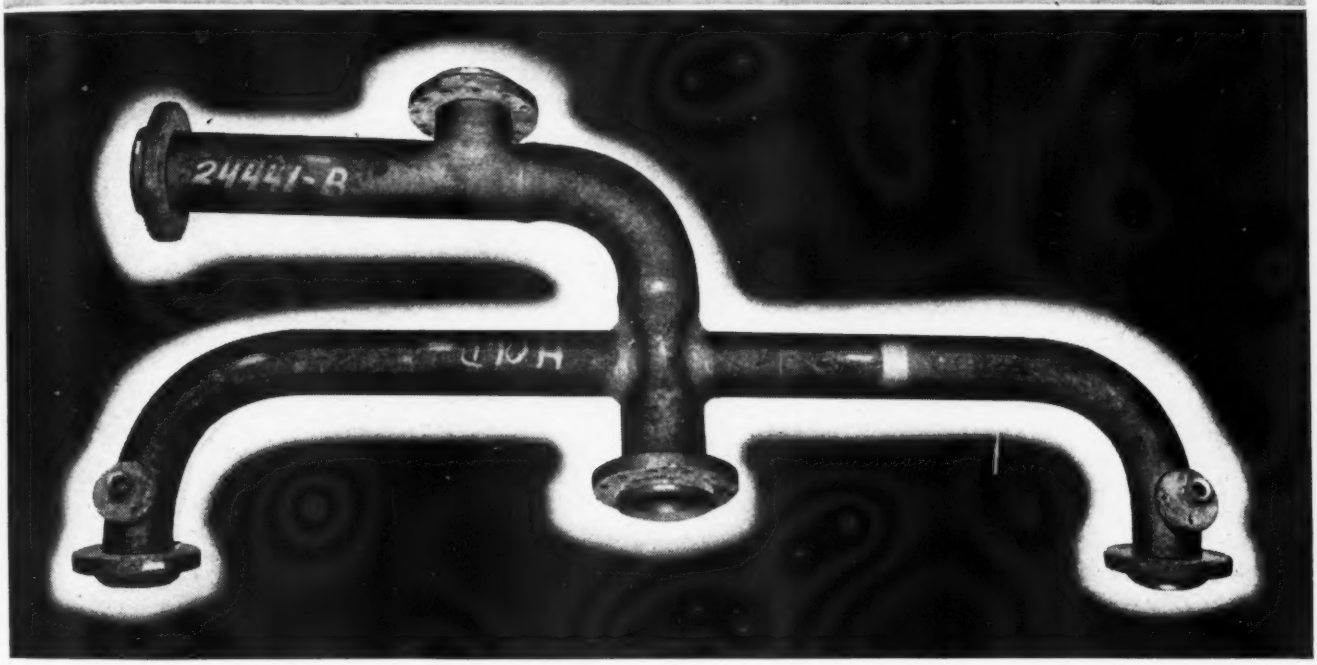
The entire instrument is built in our own plant by men and women who know how to make fine instruments. Our production is independent of the products of other instrument manufacturers.

We are fully confident that you will find these new Insulation Testers worthy members of the famous "Megger" family, and we invite your orders for them. At present we are offering ranges up to 100 and 1000 megohms with 500-volt generators. We continue to supply various other types and ratings of "Megger" instruments as formerly. Write for new descriptive Bulletin 1735-P.

JAMES G. BIDDLE CO. · 1211-13 ARCH STREET · PHILADELPHIA 7, PENNA.

23 PIPING SPECIALISTS

REQUIRED TO PRE-FABRICATE THIS SUBASSEMBLY



This piece of pre-fabricated piping doesn't look too difficult (and it isn't as piping jobs go) yet 23 specialists from engineering to testing contributed their knowledge and skill to it.

If it were made in the field, most of these specialists would have to be there . . . (not an easy matter in these days of skilled labor and transportation shortages) or a large part of the work would have to be done by men not too well trained for it. Further, they would not have the advantage of shop equipment which supplements the skill of the piping specialists employed by a qualified pipe fabricator.

Pre-Fabricated Piping is delivered to you in a series of subassemblies, each made to fit exactly into the total plan. Each is shop tested, accurately aligned, heat treated and stress relieved when necessary, thoroughly cleaned and inspected. Erection in the field is then a simple, rapid and economical operation.

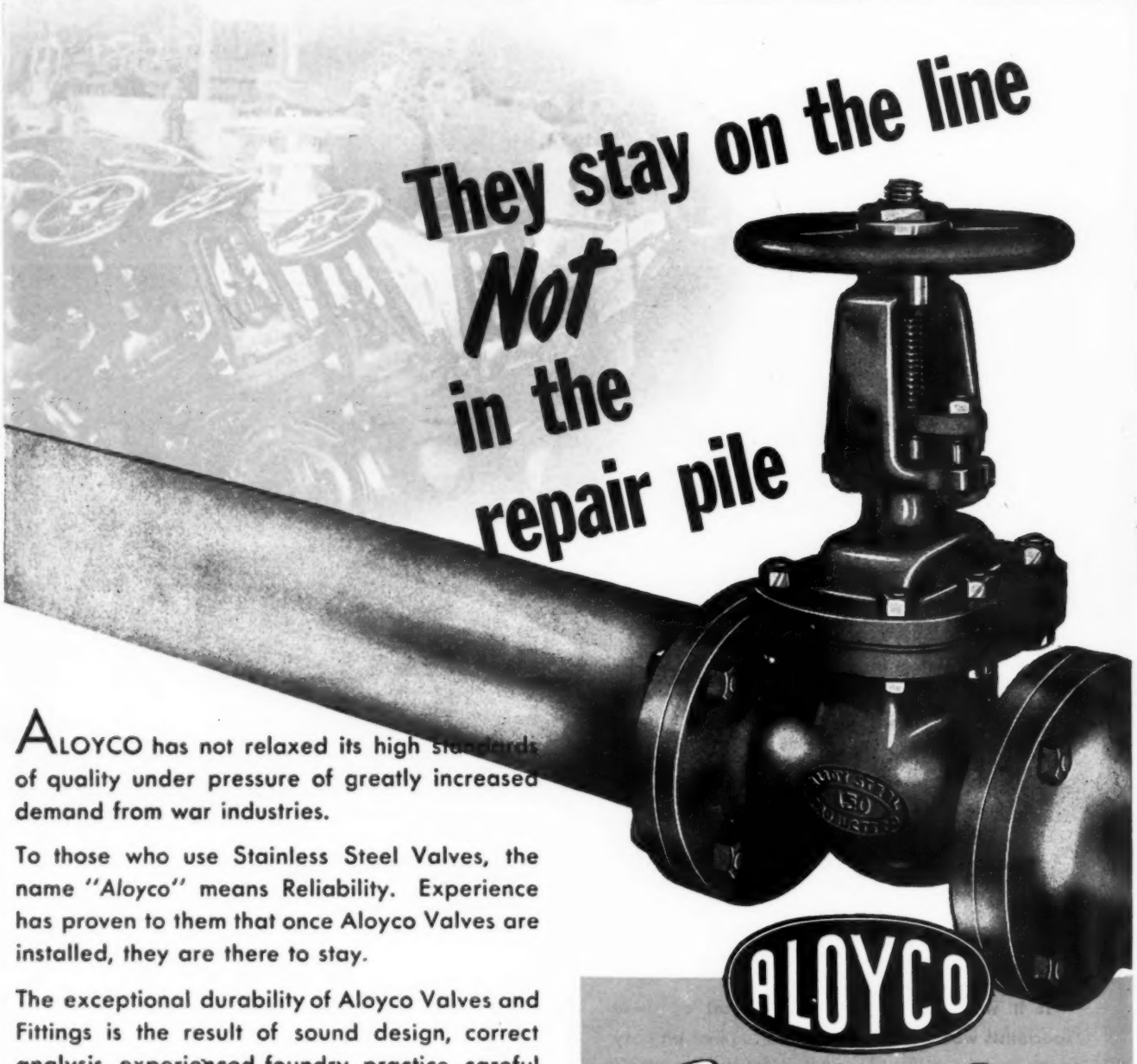
PRE-FABRICATED PIPING IS BETTER PIPING

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

ALOYCO STAINLESS STEEL VALVES



They stay on the line *Not* in the repair pile

ALOYCO has not relaxed its high standards of quality under pressure of greatly increased demand from war industries.

To those who use Stainless Steel Valves, the name "*Aloyco*" means Reliability. Experience has proven to them that once Aloyco Valves are installed, they are there to stay.

The exceptional durability of Aloyco Valves and Fittings is the result of sound design, correct analysis, experienced foundry practice, careful heat treatment, accurate machining and rigid inspection. Add them all up and they mean trouble-free service in the pipe lines of the process industries.

Send us your inquiries.

ALOYCO

Stainless Steel
VALVES and FITTINGS

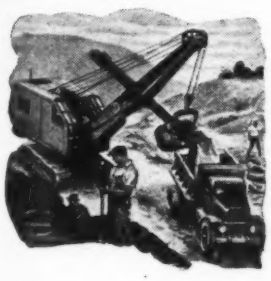
GATE VALVES • GLOBE VALVES
Y VALVES • CHECK VALVES
LEVER THROTTLE GATE VALVES
TANK VALVES • SCREWED FITTINGS
FLANGED FITTINGS
GAUGE GLASS FITTINGS

Alloy Steel Products Company, Inc., 1300 West Elizabeth Avenue, Linden, N. J.

A NEW DAY DAWNS IN RAILROADING

Flow of war materials has more than doubled the normal volume of freight hauled by the Western Pacific Railroad from Salt Lake City to San Francisco through the Feather River Canyon. Wherever the going is toughest on this rugged route, General Motors Diesel freight locomotives are the "commandos" of motive power which keep this vast stream of vital munitions moving steadily toward the men who will mop up Hirohito.

Here is a crack "Express Train" of 1865 as pictured by Currier & Ives. Four years later an important new era in our transportation and economic history was celebrated with the completion of the first railroad linking the Atlantic and Pacific.



Construction is entering a new day too. War building is being rushed ahead with reliable General Motors Diesel power. And in the days to come this dependable, rugged, economical power will be ready to do the hard jobs of peace.

Throughout history, wars have set up new milestones of transportation progress. And with this war, it is the General Motors Diesel Locomotive that is ushering in the new era. What advances the future will bring are already apparent in the present performance of these locomotives and the way they are helping to meet the abnormal demands upon the railroads today.

BACK THE ATTACK—WITH WAR BONDS

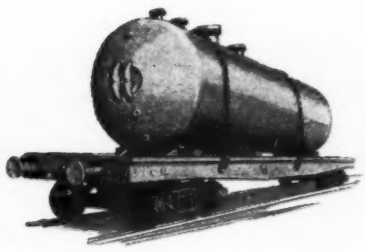
GM
GENERAL MOTORS
DIESEL POWER

LOCOMOTIVES.....*ELECTRO-MOTIVE DIVISION, La Grange, Ill.*

ENGINES..*150 to 2000 H.P.*...*CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio*

ENGINES.....*15 to 250 H.P.*.....*DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.*

Case #2043-An Air-Tight, Stress-Relieving Furnace Enclosure with Light Weight—Plus Strength



Here's the story of how the unique advantages of Bigelow-Liptak suspended construction added strength to a stress-relieving furnace enclosure, and at the same time retained adequate insulation properties.

AN ENCLOSURE that would retain light weight and adequate insulating properties—and at the same time add strength and ability to withstand handling, was needed by one of the nation's leading boiler manufacturers for a normalizing or stress-relieving furnace used in making welded pressure vessels. Because terminal time losses would consume a large part of the cycle, the heat storage of any walls and arches used would have to be kept low, not only to reduce losses from cooling of heat-soaked refractories, but to reduce the time for access to the furnace and for reheating the furnace after cooling. Conduction and radiation losses had to be kept low to save fuel and effect reasonable efficiency without sacrificing light weight and structural stability.

The inside surfaces of the furnace enclosure would have to be as air-tight as possible, consistent with natural expansion-contraction movements of the refractories. Packed expansion joints in the wall and arch surfaces would be vulnerable to attack by furnace gases in the case of any plus pressure or balanced draft conditions such as often exist in this type furnace.

Because of thermal shock resulting from opening the furnace, refractory linings would have to resist spalling. Also the lining would have to withstand rough handling of "work" or tools. The arch or roof which had to be removable by an overhead crane to permit placing "work" in and out of the furnace also would have to be rugged enough to withstand such handling and at the same time be light in weight and provide satisfactory insulation.

The Solution

The first step was to secure data from the manufacturer on the required size of the furnace, the stress-relieving temperature involved, the preferred type of burners and the type of fuel. With this information, a thorough analysis of this enclosure problem was begun by Bigelow-Liptak engineers.

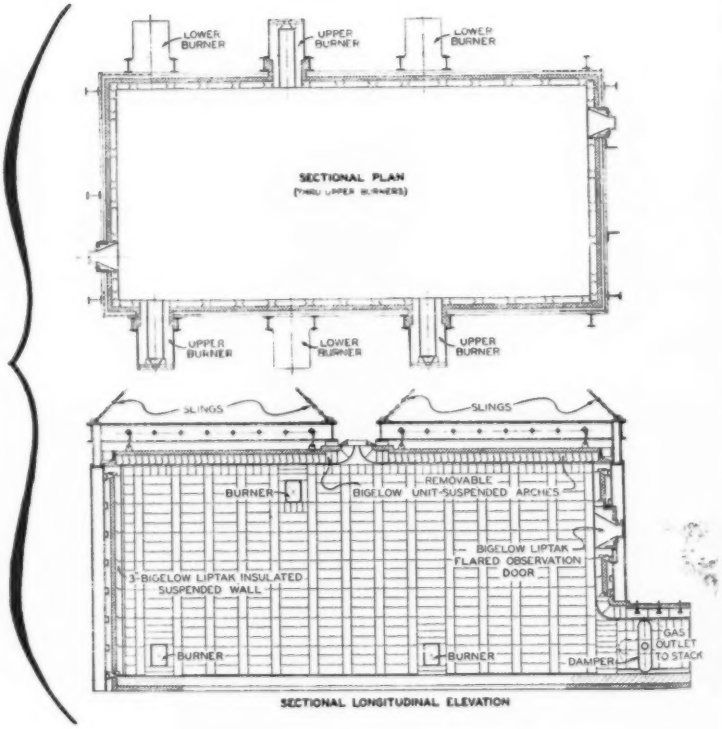
After making combustion computations to establish the maximum surface temperature to be encountered by the refractories, temperature gradients were worked out. From these, the correct combination of refractory and insulation thicknesses were established.

A study determined that Bigelow-Liptak unit-suspended thin walls would be adaptable to this problem for several reasons: (1) they are highly stable, and being unit-suspended, are rugged and capable of withstanding both thermal and structural shock, (2) would insure relatively low heat storage, (3) the unit-suspended feature would eliminate packed expansion joints, (4) the special Bigelow-Liptak method of insulation, combined with the use of thin refractories, would provide air-tightness and low conduction losses.

All of these Bigelow-Liptak advantages were incorporated in a design to provide an air-tight, light weight, stress-relieving furnace enclosure with structural strength — at low cost.

To provide an air-tight enclosure that would combine light weight with strength for this stress-relieving furnace, 3" Bigelow-Liptak unit-suspended walls and 4½" Bigelow-Liptak arches were selected. As the best possible means of resisting thermal shock from opening the furnace at intervals, and at the same time insuring adequate protection against damage from contact with tools or "work," high heat duty refractories were used. Both walls and arches were backed up with 2" of insulation. This combination reduces heat storage to a minimum.

As a means of limiting weight and size, the removable roof was designed in two sections. Added resistance to thermal and structural shock was provided by the use of heavier tile where the two sections come together.



SECTIONAL LONGITUDINAL ELEVATION

Do You Have an Enclosure Problem?

Bigelow-Liptak engineering is today solving new and old problems in all types of heat enclosures. Its record of successful installations through the years and its ability to solve new problems as they arise are based upon individualized engineering for each problem and the application of sound engineering principles that will give the user the best and most economical solution to his particular needs.

Engineering Information

Our engineering staff will be glad to send you interesting catalogs or tell you how you could secure increased service and economy by the use of Bigelow-Liptak Unit-Suspended walls and arches in your plant. Write today. No obligation.

Unit-Suspended Walls + Arches

The Key to Operating Economy

BIGELOW-LIPTAK CORPORATION
DIVISION A. P. GREEN FIRE BRICK CO.
330 Curtis Building
DETROIT

BIGELOW LIPTAK Corporation

Twenty Three Years OF SUCCESSFUL STOKER BUILDING

★ Among the many installations of Chicago Automatic Stokers is this one in operation at the main Chicago plant of Montgomery Ward & Co.—one of four installations for this company.

This particular installation is operating at an efficiency of 75 to 80%, burning local Illinois coal and operating the boiler from 200 h. p. to 1000 h. p. It is a 440 h. p. job which we converted from oil to Chicago Automatics.

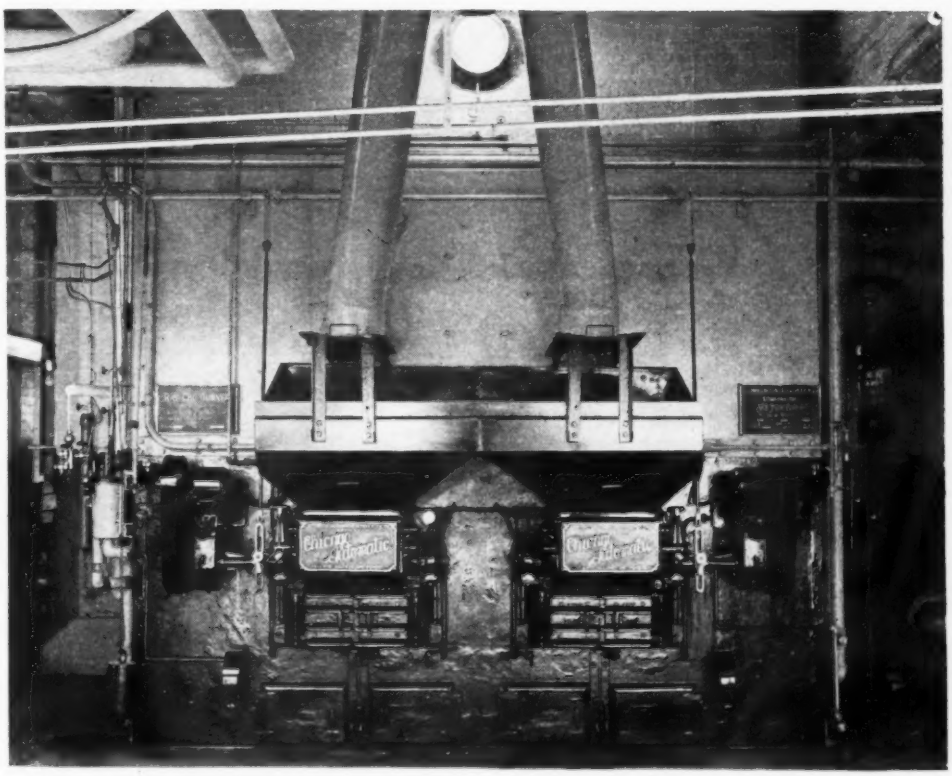
At any load, whether 200 or 1000 h. p., there is no fly ash emission from the stack nor accumulation of fly ash in boiler, breeching, or stack.

The boiler is a Combustion Engineering Co. 2-drum boiler with very small space on rear drum for cleanout. Yet, Montgomery Ward & Co. is operating two of these boilers equipped with Chicago Automatic Stokers continuously with so little accumulation at the lower drum that it is taken out in water buckets.

CHICAGO AUTOMATIC STOKER CO.
14 N. CLINTON ST. CHICAGO, ILL.

A few nationally-known users of Chicago Automatics:

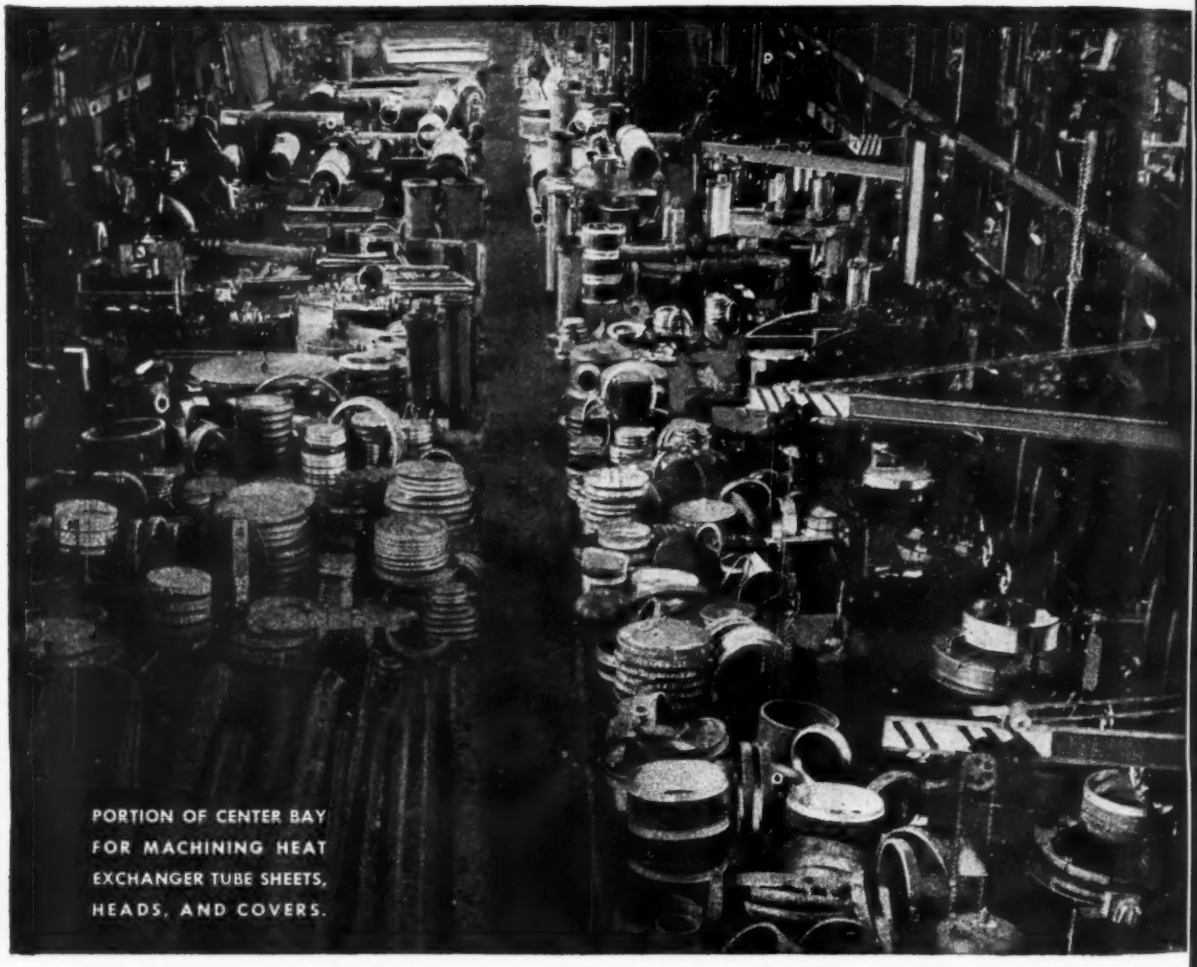
- Estate of Marshall Field (Conway Building, Chicago)
- Glidden Co.
- Sherwin-Williams
- Great Northern R. R.
- Berghoff Brewery Co., Ft. Wayne, Ind.
- La Salle Hotel, Chicago
- Checker Cab Co., Kalamazoo, Mich.
- Camp Crowder, Neosha, Missouri
- Ming Toy Dye Co.
- Certainteed Products Co.
- Edison General Electric Appliance Co.
- Sangamo Ordnance Plant, Illiopolis, Ill.



Chicago Automatic STOKERS

ALCO

ENGINEERS AND MANUFACTURERS



PORTION OF CENTER BAY FOR MACHINING HEAT EXCHANGER TUBE SHEETS, HEADS, AND COVERS.

ALCO Manufactures Heat Exchangers for the Oil and Chemical Industries, Power Plants, General Industry, and Marine Service.

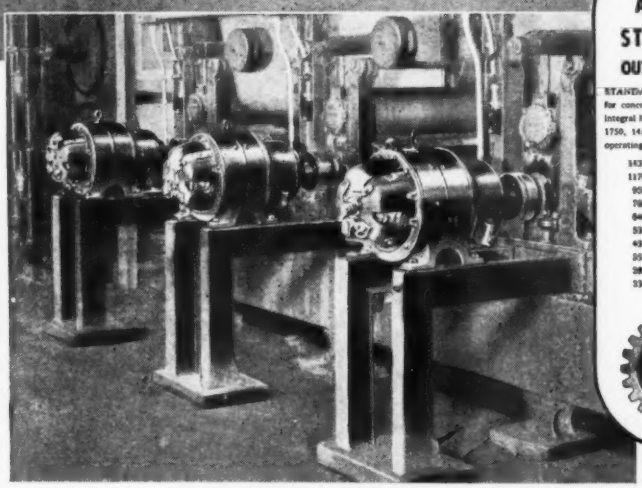
Write for Bulletin No. 1030 for Listing of Products

AMERICAN LOCOMOTIVE COMPANY

ALCO PRODUCTS DIVISION

30 CHURCH ST., NEW YORK (8), N. Y. **DUNKIRK, N. Y.**

for *LINE DRIVES* or *DIRECT CONNECTED DRIVES* make your choice Philadelphia MOTOREDUCER



★ **A.G.M.A. STANDARD OUTPUT SPEEDS**

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

1430	100	25
1170	155	30
900	125	15.5
700	100	13.5
540	84	11.0
520	68	9.0
420	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

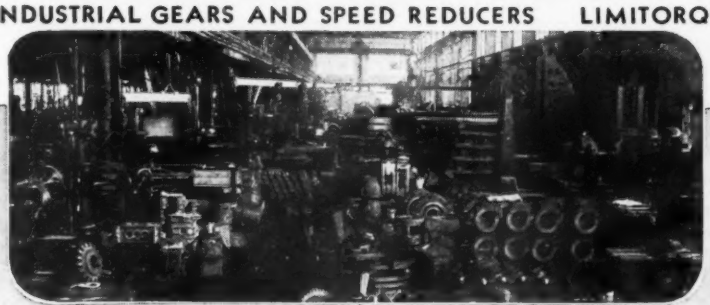
AGMA

The compact design of the Philadelphia MotoReduceR with its motor and speed reducer in a single housing greatly simplifies installation, and makes it an ideal choice for service where other types of drives are impractical. Furthermore, its rugged construction assures dependable, trouble-free performance with little attention. This has been proven by the countless units in service in all kinds of industrial plants during the past decade. Philadelphia MotoReduceRs are made in both horizontal and vertical types, in a wide range of horsepowers and ratios, with practically any available motor construction. Get our catalog MR 40 for details.

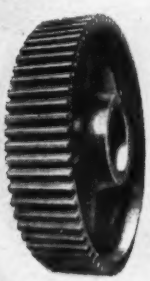
PHILADELPHIA GEAR WORKS, INC.

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

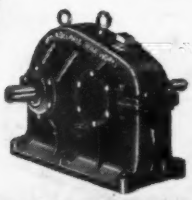
ERIE AVENUE & G STREET
PHILADELPHIA 34, PENNA.
NEW YORK, PITTSBURGH, CHICAGO



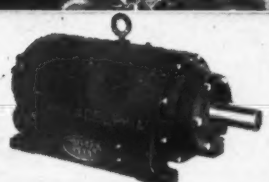
***Philadelphia* LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.



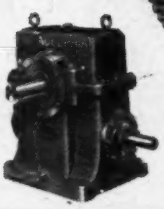
***Philadelphia* GEARS** All types and sizes of industrial gears. Can be supplied in all materials.



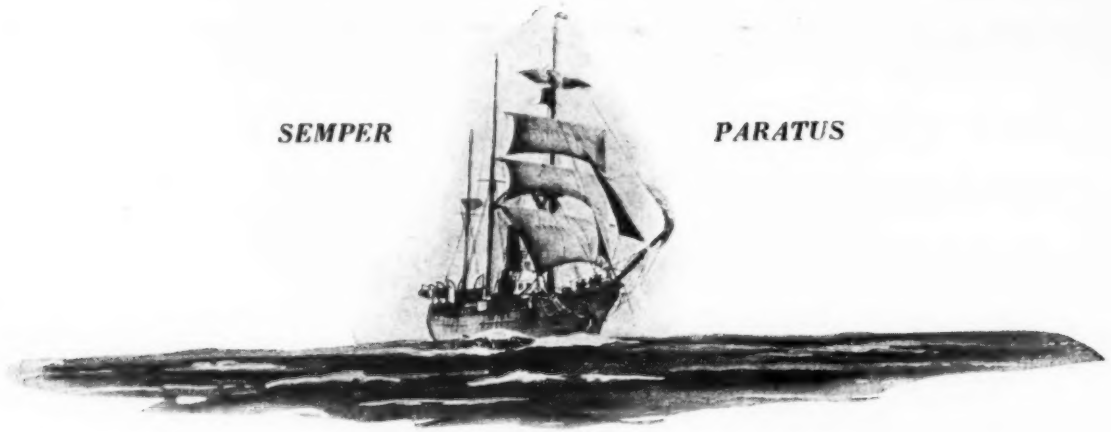
***Philadelphia* HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



***Philadelphia* MOTOREDUCER** The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



***Philadelphia* WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

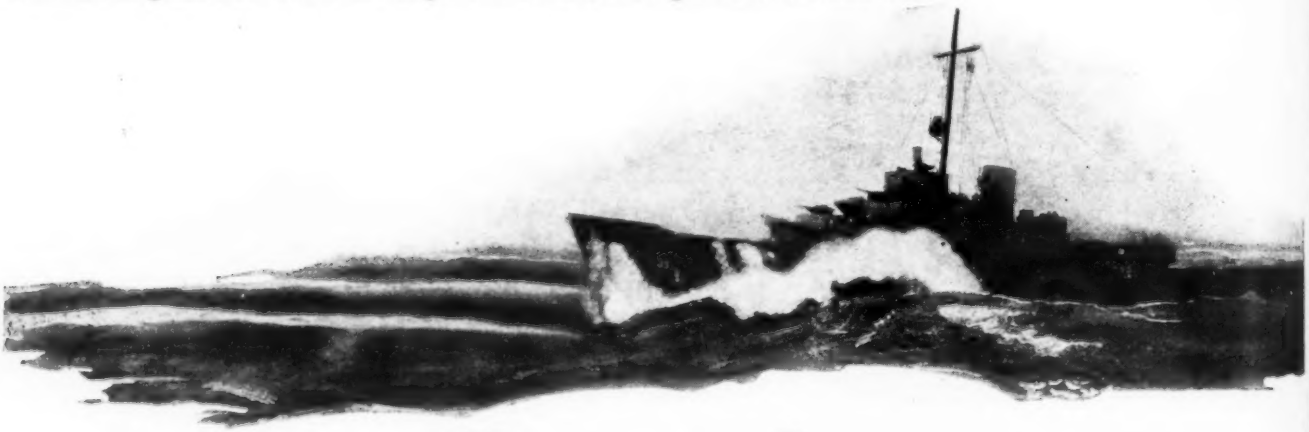


FROM THE OLD COAST GUARD "BEAR" TO THE NEWEST 327′ CUTTER

Worthy as she is, the old Coast Guard Cutter BEAR—back on duty—cannot compare with the new, sleek 327 foot PG's with their 6,200 horse power doing better than 20 knots.

THERE HAS BEEN PROGRESS IN WATER CONDITIONING, TOO . . . Passing out are the former "standard practices" for water conditioning. Today, through skilled diagnosis and preventive measures, the enemies of steam production and of other industrial uses of water—scale, corrosion, carry-over and embrittlement—are stopped *before* they can apply their destructive power.

The Bird-Archer Organization of Mechanical Engineers, Chemical Engineers and Chemists is fully staffed and entirely competent to analyze water conditioning requirements in your plant and to set up the proper conditioning method. No other organization is better qualified for this work.



THE BIRD-ARCHER CO.

Water Conditioning Service

SURVEYS • PLANT STUDIES • CONSULTATIONS
PLANT DESIGN • SUPERVISORY SERVICE
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NEW YORK *N. Y.*
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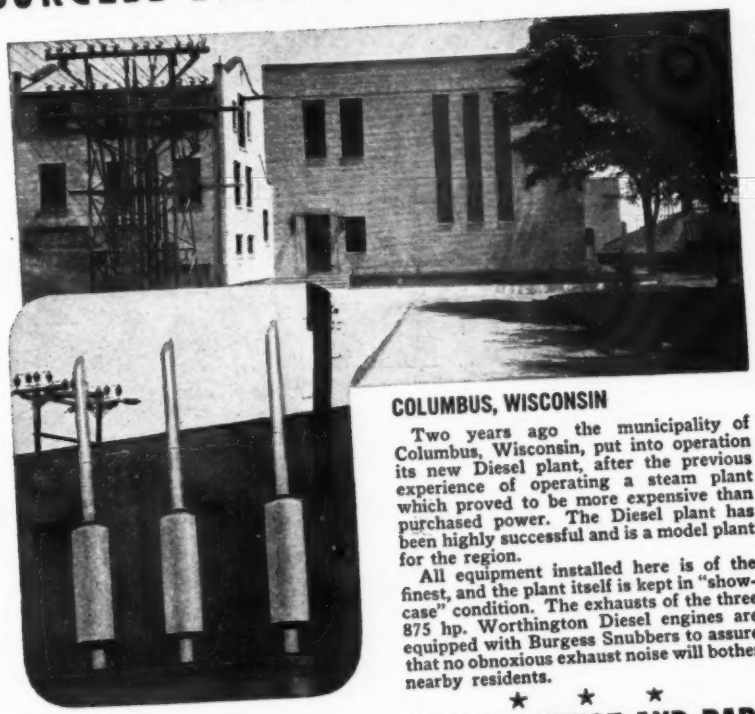
MONTREAL *CAN.*

Official U. S. Coast Guard Photo

RGESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA

BURGESS SNUBBER BULLETIN on Diesel Exhaust Noise Control



COLUMBUS, WISCONSIN

Two years ago the municipality of Columbus, Wisconsin, put into operation its new Diesel plant, after the previous experience of operating a steam plant which proved to be more expensive than purchased power. The Diesel plant has been highly successful and is a model plant for the region.

All equipment installed here is of the finest, and the plant itself is kept in "showcase" condition. The exhausts of the three 875 hp. Worthington Diesel engines are equipped with Burgess Snubbers to assure that no obnoxious exhaust noise will bother nearby residents.

★ ★ ★

Chipley's New Book on Modern Spark Arrester Design

The favorable reception of Burgess' booklet by Chipley, entitled "Diesel Engine Exhaust Silencing," has encouraged the Acoustic Division to publish a similar booklet covering Chipley's investigation of the relative efficiencies of various means of separating sparks from exhaust gases. This booklet is available upon request and is offered with the sincere wish that it too may prove helpful.

Since engineer Chipley is now Lieutenant Chipley, assigned to the Army Air Force VIII Bomber Command stationed in England, the manuscript of this booklet was completed by an associate, Mr. Howard H. Darbo, who is patent counsellor for the Acoustic Division.

Like the preceding booklet, this one is an engineer's analysis of its subject. It details the development of the spark arrester from the first crude types used on woodburning locomotives to prevent fires, to the efficient Burgess Spark-Arrester, which removes 99.6% of solid matter from exhaust gases. Burgess Spark Arrester-Snubbers are widely used in marine and industrial installations. The Acoustic Division will be glad to send you a copy of this helpful booklet on request.

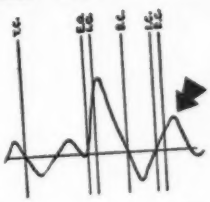
★ ★ ★

USING EXHAUST GAS ENERGY TO SCAVENGE AND PARTIALLY SUPERCHARGE TWO-STROKE-CYCLE ENGINES

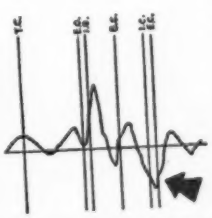
Every engineer familiar with crankcase scavenged two-stroke-cycle engines knows that good performance depends on obtaining the proper length of exhaust pipe as well as on scavenging air pressure.

Burgess engineers found that by properly tuning the exhaust system, exhaust gas energy will scavenge the cylinder without any help from crankcase air pressure, and also cause a partial supercharging effect.

When the exhaust port opens at the bottom of the power stroke, burned gases expand into the exhaust pipe. The intake port then opens. If the exhaust system is properly tailored, pressure in the cylinder goes to atmospheric at about bottom dead center. Pressure in the cylinder continues to fall rapidly, and both burned gases and some clean air flow out through the exhaust pipe.



Favorable condition. Pressure rising as intake port closes; pressure up as exhaust port closes.



Unfavorable condition. Pressure below atmospheric as both ports close. Lack of clean air in cylinder will cause poor combustion.

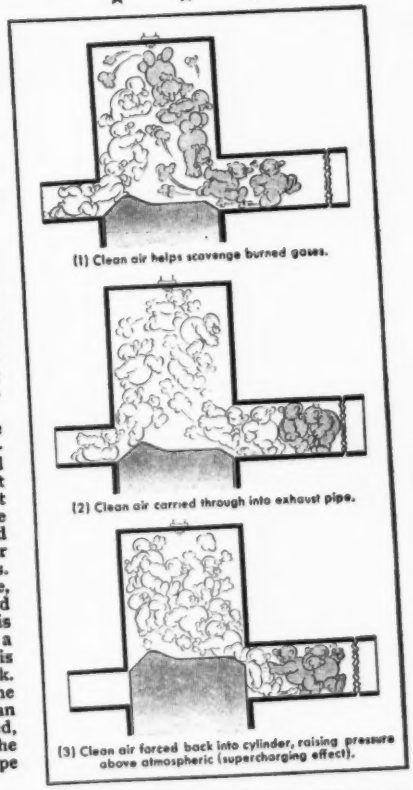
As the intake port closes, the gas flow reverses itself. Pressure rises as the air in the exhaust pipe rams back into the cylinder. By the time the exhaust port closes, the reverse flow has been sufficient to build up a pressure above atmospheric.

It may appear that this reversal of flow forces burned gas back into the cylinder. However, if there is no undue restriction at the inlet, an excess of clean air will have passed across the top of the cylinder and into the exhaust pipe, and it is this clean air which is rammed back into the cylinder.

Of course, these pressure changes will not occur in this way unless the exhaust system is properly tuned. The object is to get the gases to oscillate in exactly the right way. Once this is accomplished, the intake port can be connected directly to the atmosphere.

It is necessary to arrange the system so that the direction of the flow is outward through the exhaust port from the time the exhaust port opens until the intake port closes. Then, air should flow back into the cylinder until the exhaust port closes. By using a telescoping pipe, its length may be changed gradually while the engine is running under full load. If a cathode ray oscillograph is available, it will greatly simplify this task.

Finally, a Snubber and tail pipe of the correct size for the engine in question can be installed. The Snubber can be specified, but it's a good idea to again employ the "trombone" pipe to find the exact tail pipe length for greatest efficiency.



(1) Clean air helps scavenge burned gases.

(2) Clean air carried through into exhaust pipe.

(3) Clean air forced back into cylinder, raising pressure above atmospheric (supercharging effect).

Published by ACOUSTIC DIVISION, BURGESS BATTERY COMPANY — 2823-L W. Roscoe St., Chicago 18, U.S.A.

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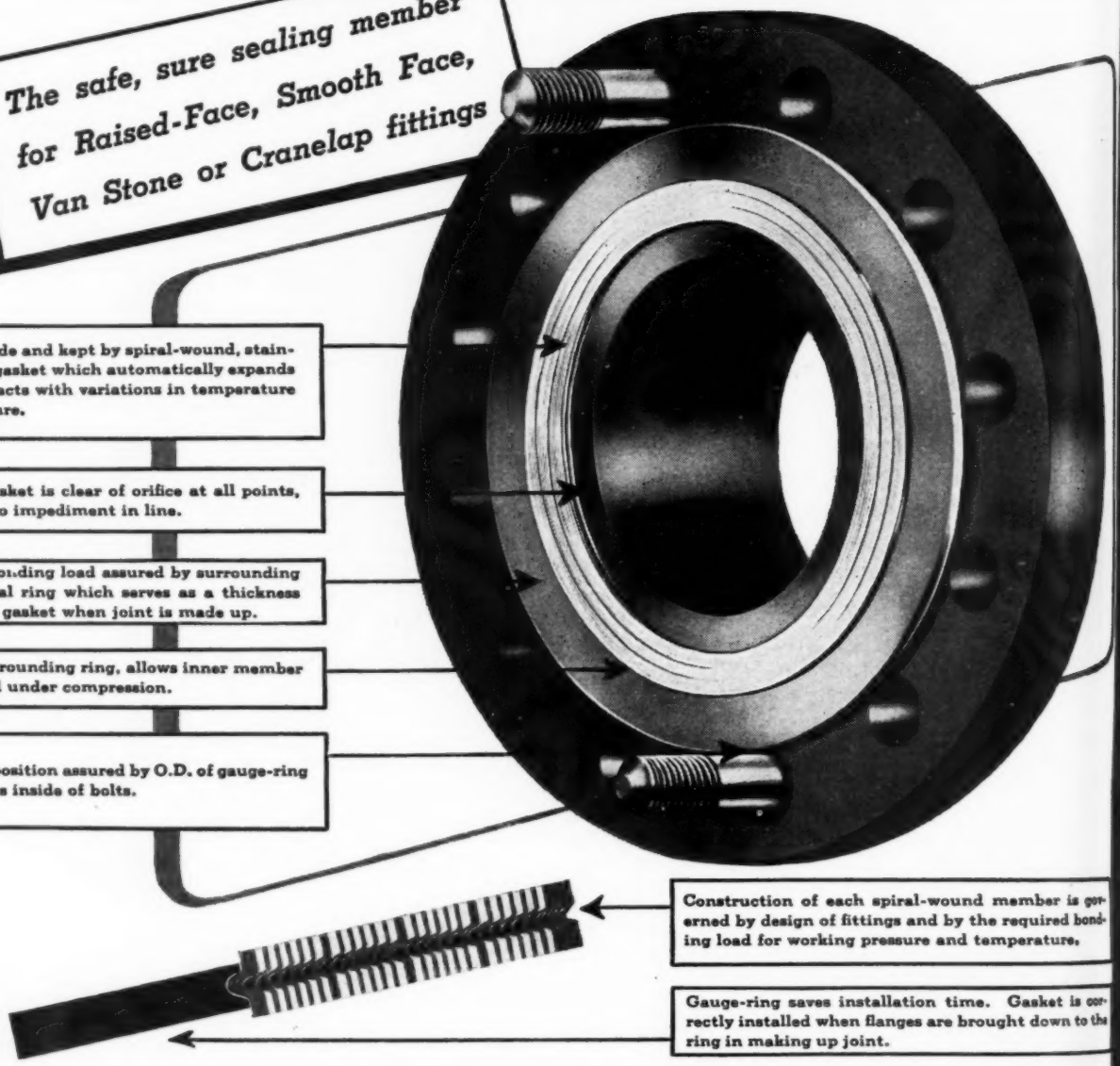
GESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA

COMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR COM

MILLIONS IN WAR SERVICE

FLEXITALLIC "C-G" GASKETS FOR HIGH-PRESSURE FLANGED JOINTS

The safe, sure sealing member for Raised-Face, Smooth Face, Van Stone or Cranelap fittings



Seal is made and kept by spiral-wound, stainless-steel gasket which automatically expands and contracts with variations in temperature and pressure.

I.D. of gasket is clear of orifice at all points, offering no impediment in line.

Correct bonding load assured by surrounding solid-metal ring which serves as a thickness gauge for gasket when joint is made up.

Fit of surrounding ring, allows inner member to expand under compression.

Correct position assured by O.D. of gauge-ring which fits inside of bolts.

Construction of each spiral-wound member is governed by design of fittings and by the required bonding load for working pressure and temperature.

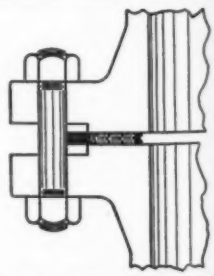
Gauge-ring saves installation time. Gasket is correctly installed when flanges are brought down to the ring in making up joint.

Most of the war service of Flexitallic Style C-G gaskets is in flanged joints aboard ship—as severe a service as can be found. Here steam is held despite weaving of the lines as the ship plows through the sea. Here loss of steam could cause disaster, not only locally but to the ship itself. It is service that involves huge responsibility for a gasket.

Come to know these C-G gaskets well. Time approaches when you will want the security in your lines that hundreds of ships now have. We will be glad to send you a leaflet about them; just say Style C-G Flexitallic Gaskets.

"Flexitallic" Reg. U.S. Pat. Office

Representatives in Principal Cities

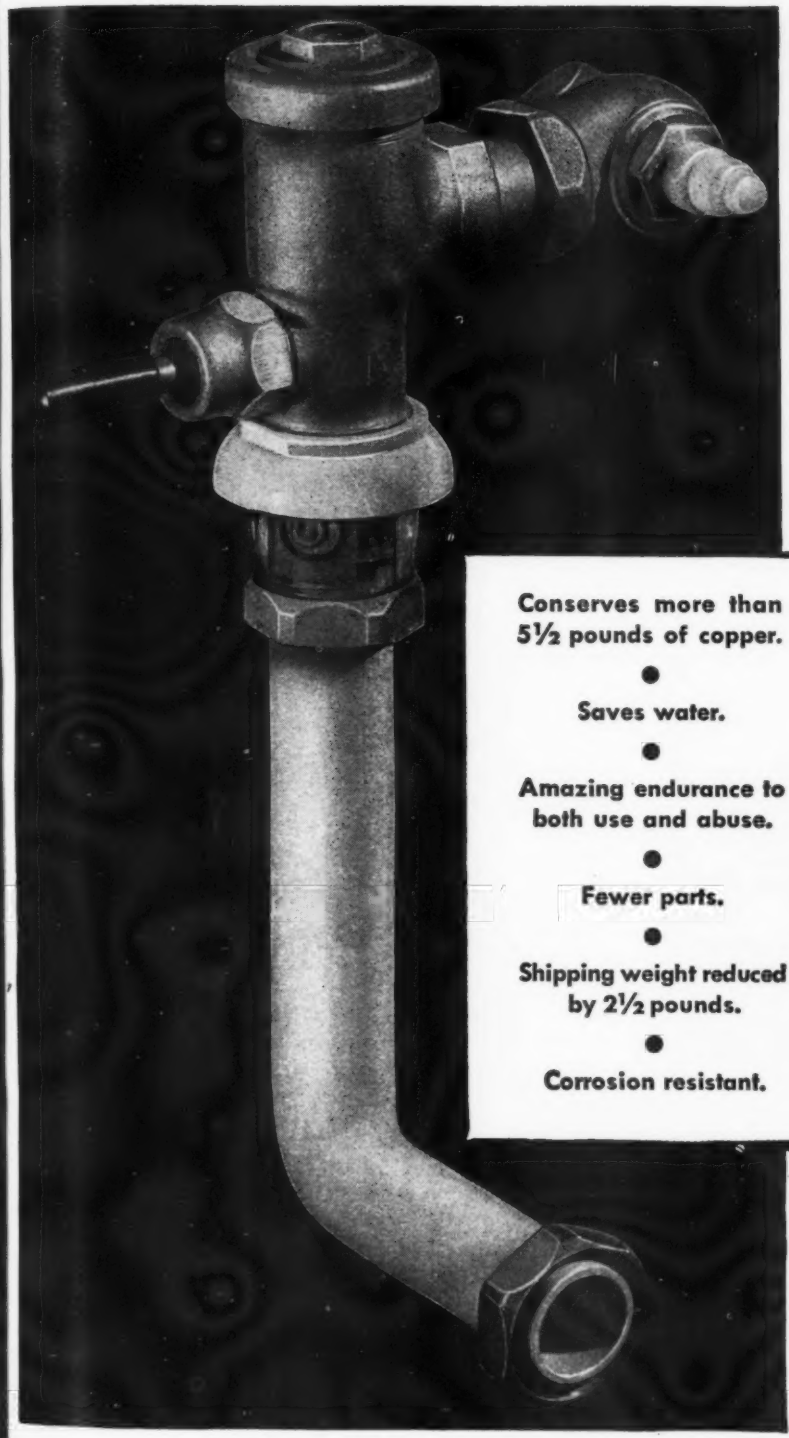


Diagrammatic section of a C-G Gasket with typical Raised Face fittings showing the flanges compressed to the thickness of the solid metal member.

FLEXITALLIC GASKET CO., 8th and Bailey Streets, Camden, N. J.

Originators of Spiral Wound Construction

SAVES..5½ lbs. of copper per valve!



Conserves more than 5½ pounds of copper.

●

Saves water.

●

Amazing endurance to both use and abuse.

●

Fewer parts.

●

Shipping weight reduced by 2½ pounds.

●

Corrosion resistant.

■ Sloan Victory Flush Valves save over 5½ pounds of copper per valve for war matériel. This means that Sloan alone is conserving over 2,000 *tons* of critical copper annually, based on 1942 production figures.

This amazing reduction was brought about through the substitution of plastics and malleable iron. All the malleable iron parts are attractively finished with a baked-on protective coating applied both inside and out. A plastic sleeve lines the iron body to provide a smooth, wear-resisting surface for moving parts.

While the Sloan Victory Vacuum Breaker is all-plastic, no change was made in the functional design of the original Sloan V-100-A which was the first vacuum breaker to be approved by the N.A.M.P. Its outer shell, now of transparent plastic, permits *visual* inspection, thus assuring the ultimate in protection against back-syphonage.

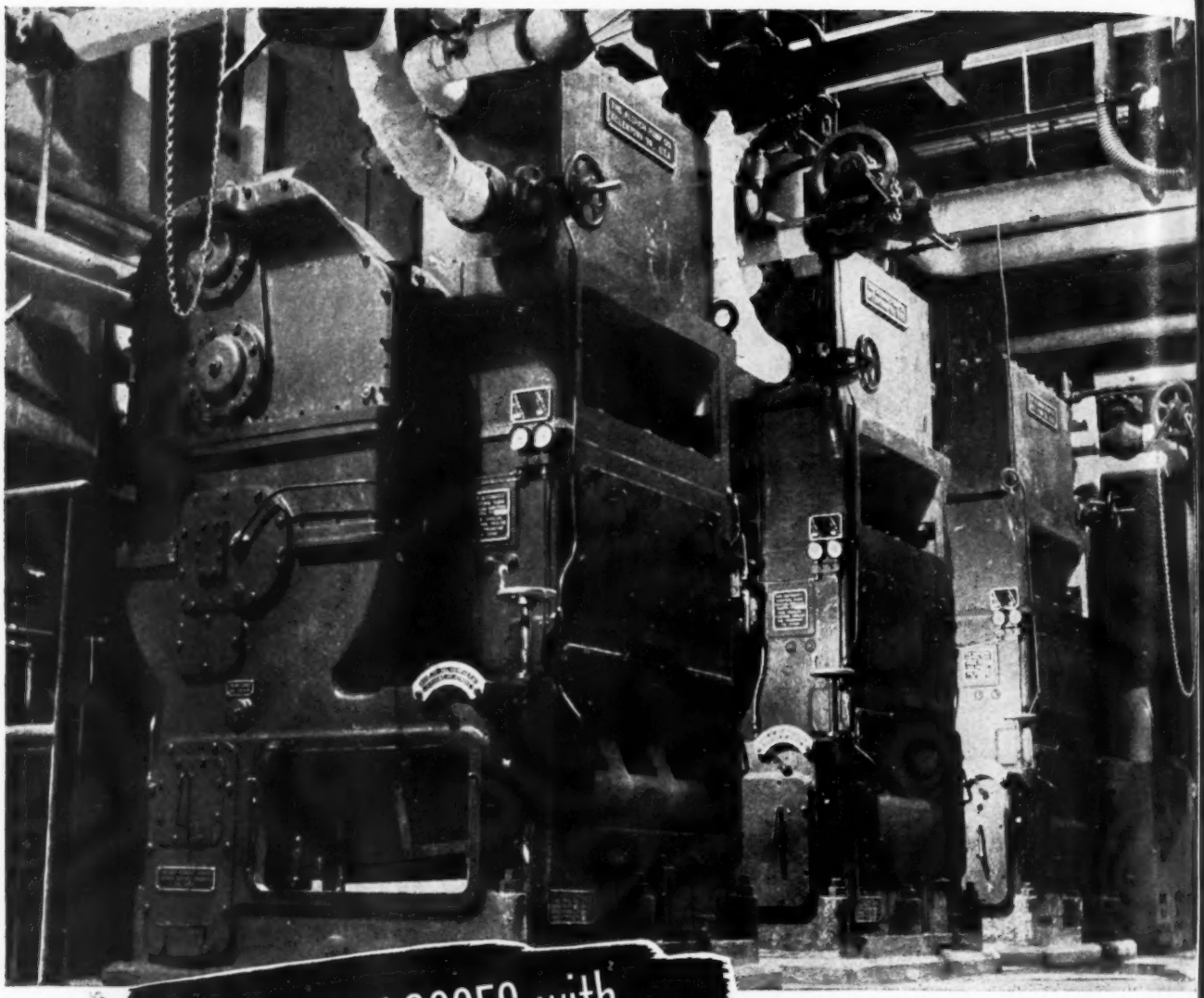
In the new Victory Valve, the Sloan Valve Company has applied its every resource to produce a high quality flush valve, and vacuum breaker which in cooperation with the War program, used the irreducible amount of precious copper.

Remember: it is *patriotic* to specify and order Sloan—the flush valve using the least amount of critical metal.

The new Victory Vacuum Breaker is all-plastic; its transparent outer-shell affording visual inspection. Instantaneous in action, it prevents back-syphonage and so protects health.

SLOAN VALVE COMPANY . . 4300 West Lake St., *Chicago*

SLOAN *VICTORY TYPE* FLUSH VALVES



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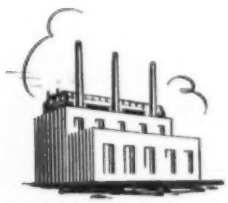
. . . ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMPS

Aldrich-Groff pumps on unit feed systems eliminate pressure and power losses common to throttling-type feed regulating valves and offer advantages of feed system simplicity, efficiency and mechanical reliability for small and medium installations at medium and high steam pressures.

Equally important overall power savings are effected by Aldrich-Groff pumps on de-superheater feed service in connection with high pressure topping units for power stations of any size.

The three Aldrich-Groff 3¼" x 0 to 6" variable stroke vertical triplex pumps shown above are in service in a mid-western central station employing the unit system for main boiler feed. Two are driven by constant speed motors and the third by a constant speed steam turbine. Power consumption is almost directly proportional to pump delivery.

The 6" stroke — 3¼" plunger pump is a 100 HP unit and when operating at maximum speed can deliver 70,000 pounds of feed water per hour against 1025 pounds boiler pressure.



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for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

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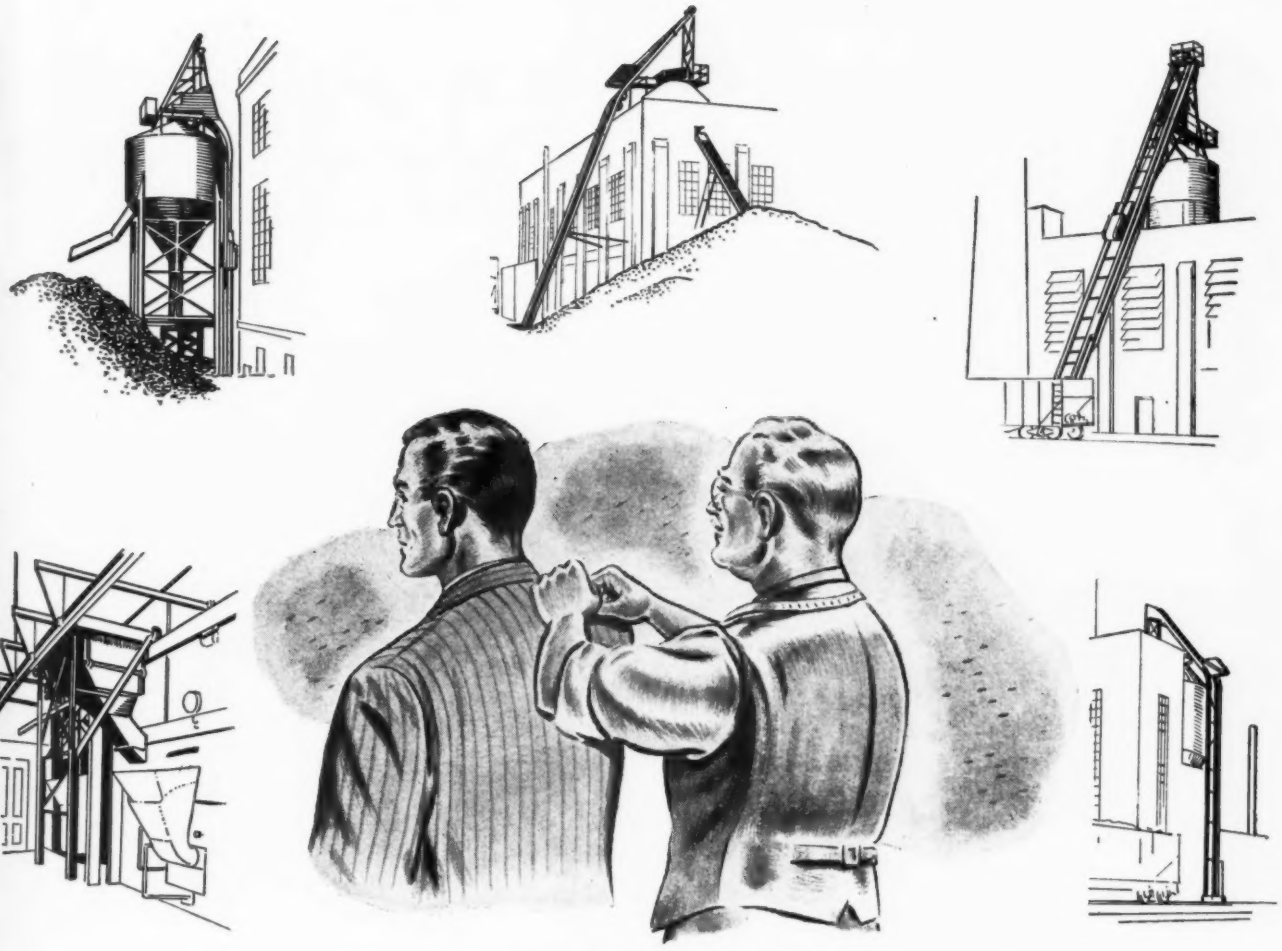

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A letter for more details involves no obligation, or, send for a copy of our Bulletin No. 83. It contains much information of interest to every works manager, engineer, or power plant superintendent.— Coal Handling Department —The C. O. Bartlett & Snow Company—6205 Harvard Avenue, Cleveland, Ohio.

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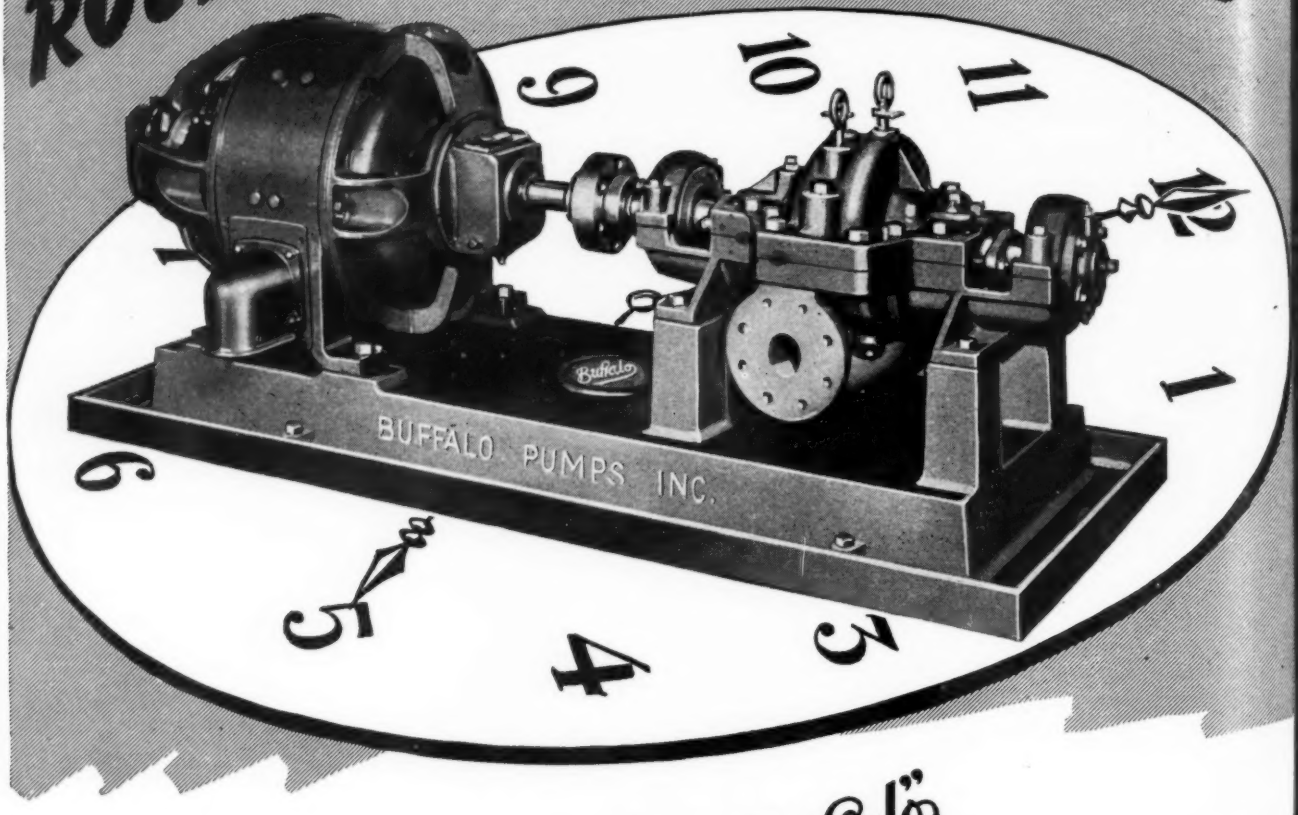

. . . that's when sturdy "Buffalo" construction . . . is an asset!

These days there's "no time off" for Buffalo General Service Pumps—and none needed! They're engineered for the gruelling service war production commands. Just check through their specifications detail by detail—you'll find intelligent, time-tested design backed by skillful workmanship. Extra ruggedly built, hydro-dynamically balanced for vibrationless operation. Buffalo Pumps keep up their 24-hour-a-day shift with top efficiency and practically no maintenance attention.

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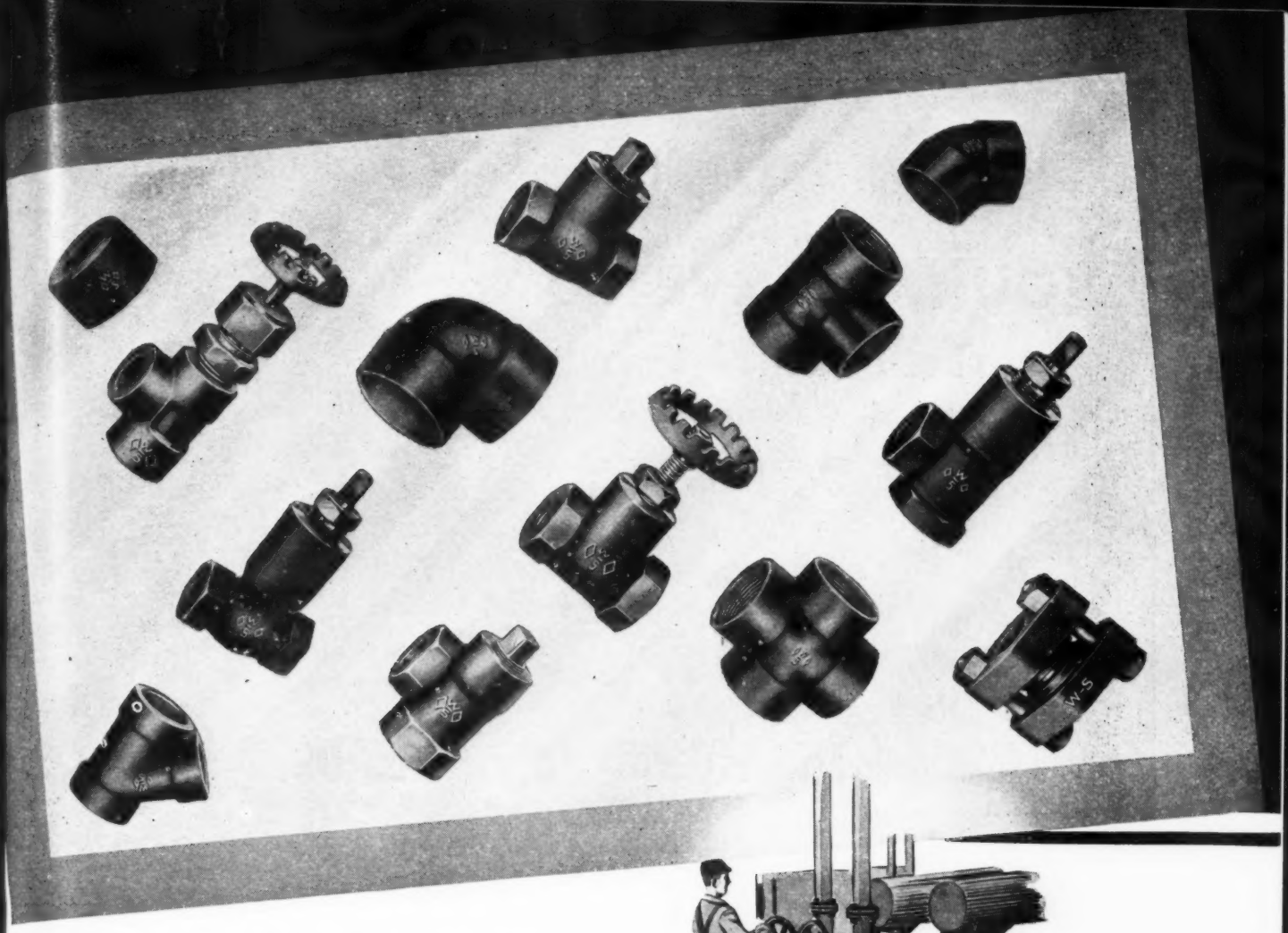

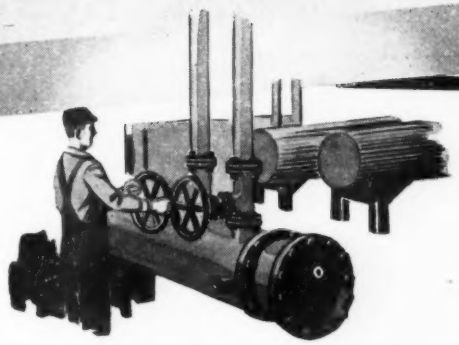

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"TOLEDO"
#101
FULL MOUNTED
BOLT SET
¼" - ⅝" INCL.

YOU DO HAVE TO TRY THEM

Then you will be convinced that "TOLEDO" has the finest bolt threading tools on the market today.

The easy adjustment for deep, shallow or standard threads will appeal to you.

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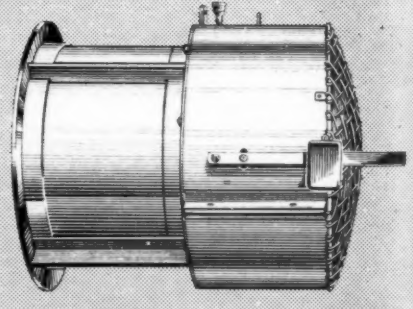
Another WING *Product*



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Type COM (Two Stage)

Used for statics of 4" and over. (For less than 4", use Type EMD). Volumes up to 35,000 cfm. Higher capacities can be furnished in special designs. Built-in volume control and re-directing vanes permit simplified capacity variation either manually or automatically. Falling horsepower characteristics with dampering. Motors are constant speed, fully enclosed and dustproof. Static efficiencies up to 70% and more. Uses: Forced draft for oil or gas burners, stokers, pulverized fuel, and hand-fired boilers. Mounted horizontally or vertically; on floor, or directly on windboxes. Suitable also for brick wall mounting.

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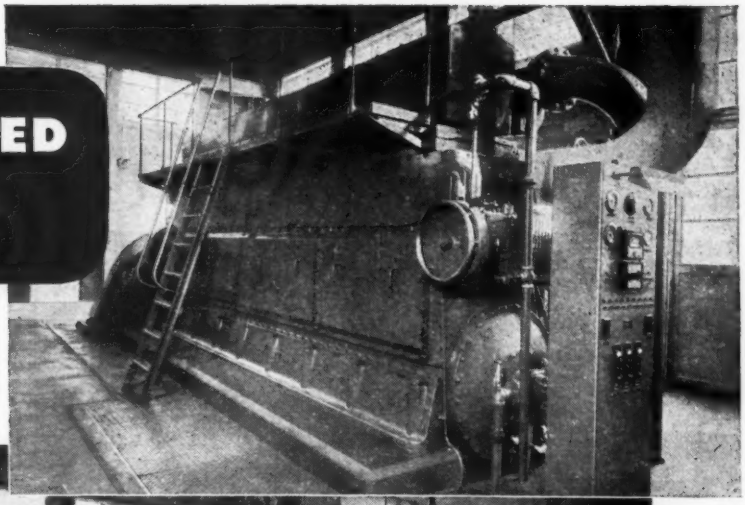
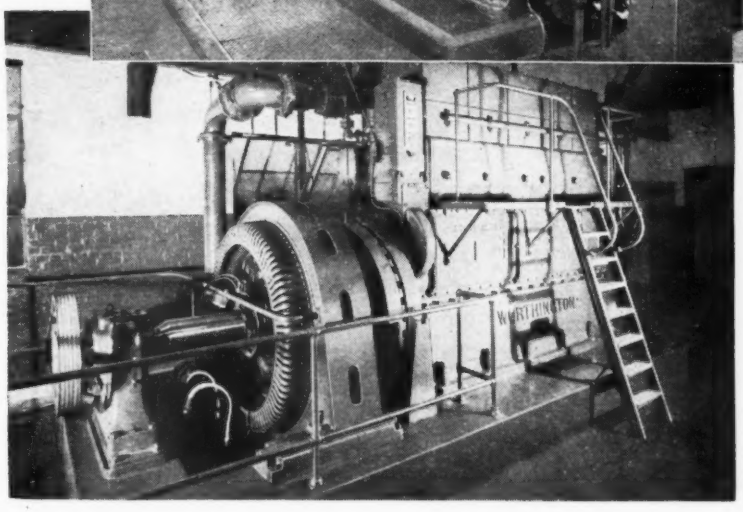
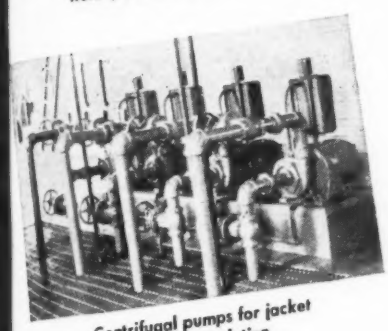




Air compressors for starting

Rotary pumps for fuel-oil transfer



Centrifugal pumps for jacket water circulation

Evaporative coolers for jacket water cooling

The outstanding reliability of Worthington diesel and gas engines is a matter of definite record in hundreds of installations, and in a wide variety of applications. They are giving unbroken performance—with high operating efficiency—over long periods of continuous service.

And, all Worthington auxiliaries . . . air compressors for starting, rotary pumps for fuel-oil transfer, centrifugal pumps for jacket water circulation and evaporative coolers for jacket water cooling . . . give additional service security through the undivided responsibility of one maker.

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Thousands of horsepower of Worthington engines . . . in Army and Navy bases, ordnance plants, industrial and municipal power plants . . . are now carrying important parts of the United Nations' war power load.

DIESEL ENGINES
150 to 1500 hp.

GAS ENGINES
175 to 2880 hp.

CONVERTIBLE GAS-DIESEL ENGINES
150 to 1500 hp.

TO ALL FOUR WORTHINGTON PLANTS FOR EXCELLENCE IN WAR PRODUCTION

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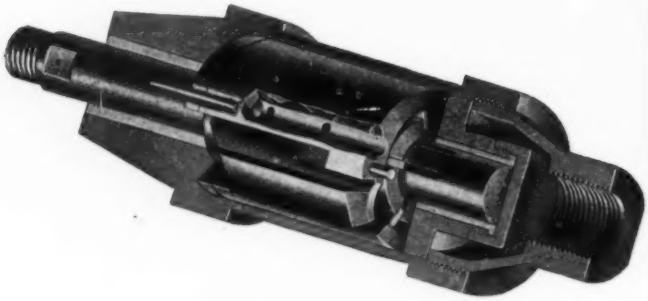
WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION • HARRISON, NEW JERSEY

It takes GUTS!



To do the job of a fighting Marine, it takes something down inside. And, to do the tough job that a tube cleaner encounters, it takes something down inside. In Airetool Tube Cleaner motors you find that extra something. It is a unique power seal that saves power for the job to be done.

This Airetool power seal permits the use of heavier cutter head combinations to combat severe deposits. Motor will not stall even when loaded down to 50 R.P.M. Picks up quickly when power is applied.

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Representatives in Principal Cities
New York Address, 50 Church St.

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ADSCO Storage Vertical Type Water Heaters are Installed in DE Escort Vessels.

Put your heater problems up to ADSCO

The peace time performance of ADSCO Heaters in some of America's largest industrial plants, commercial establishments, institutions and hospitals is exceeded only by their war record.

Not only has there been an unprecedented demand for ADSCO Heaters for normal peace time outlets now operating on a war basis but the war has brought many new applications such as heaters for the famous DE Escort Vessels illustrated above — cargo ships, tankers, tugs — army camps — naval and air bases.

Whatever your heater problems, put them up to ADSCO. Scarcely two sets of operating conditions are exactly alike. That is why a heater should be built to meet your particular requirements — otherwise it may not operate with the greatest efficiency and economy.

ADSCO has had over sixty years of experience in building heaters of various types and descriptions — horizontal or vertical — storage or instantaneous — heat economizers and special equipment to heat or cool water, oil or other liquids. Submit the details of your heating or cooling problems to us, or write for bulletin No. 35-75PR.

ADSCO Storage Vertical Type Heater

AMERICAN DISTRICT STEAM COMPANY
North Tonawanda, N.Y.
MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

ADSCO HEATERS
ARE BUILT JUST RIGHT FOR YOUR JOB

FIT THE VALVE TO THE SERVICE

KEEP SHIPSHAPE

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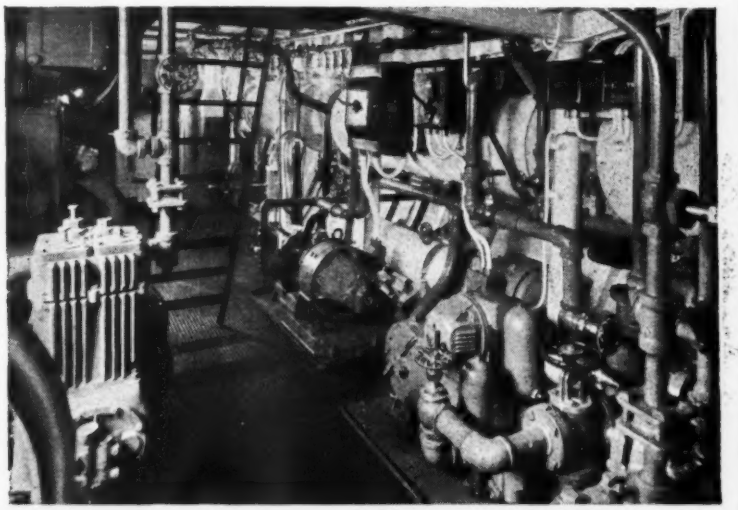

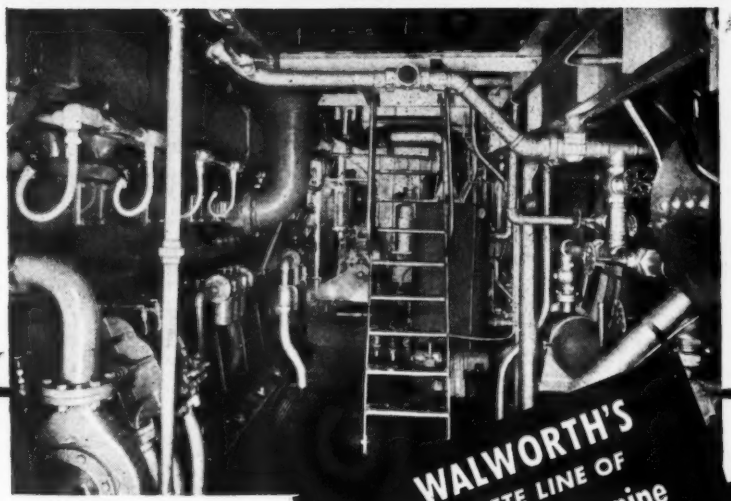

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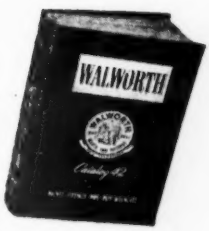
Where brass or copper pipe or tube is used in power plants, afloat or ashore, Silbraz joints made with Walseal valves, fittings, or flanges, should be installed. Silbraz joints have proven their ability to withstand bomb shock and vibration, resist corrosion, and remain tight and leakproof. The joints cannot creep or pull apart under any temperature to which the tube or pipe can be safely subjected. Silbraz joints are easy to install, even in difficult locations, and they keep piping systems shipshape. Write for detailed information.



To help you "fit the valve to the service" you will find pertinent information on Walworth's complete line in Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write on your business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York 17, N. Y., Department 95.

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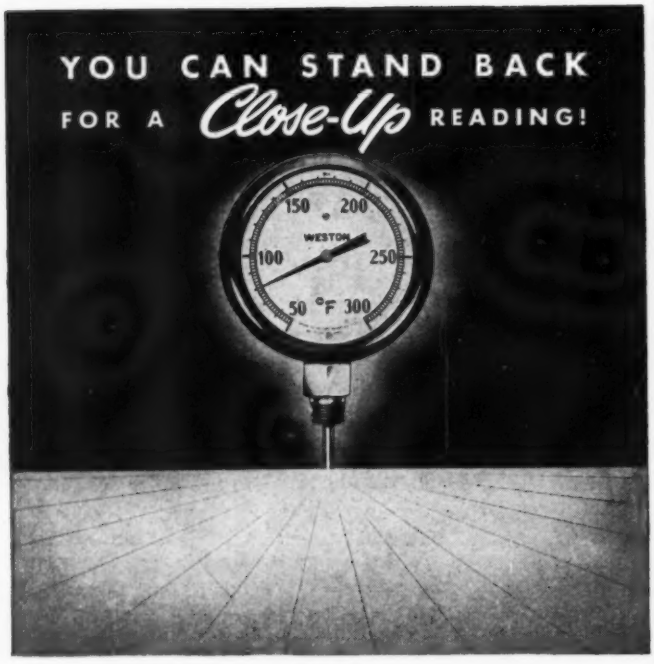

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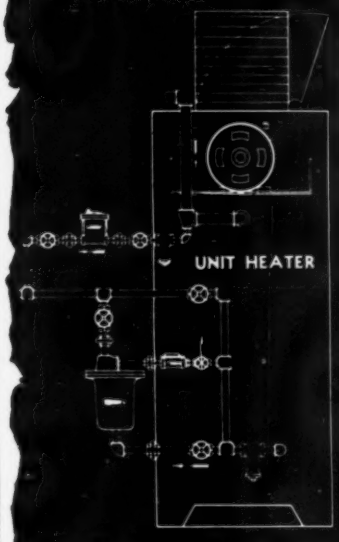
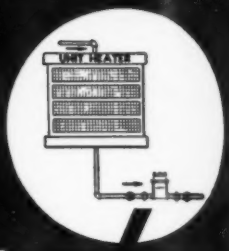


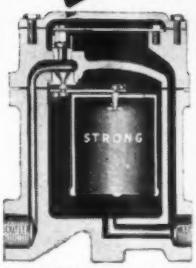
FLOOR-TYPE HEATER with Strong 70 Series trap draining inlet line, and 80 Series with Thermal Air Valve draining heater. Note strainers ahead of traps. OVERHEAD HEATER (circle) drained by Strong 70-T trap, with built-in thermal vent.



Accumulated condensate and trapped air can make unit heaters slow in starting. Uncertain drainage can seriously reduce heat output.

Leaky Traps Waste Fuel

While all Strong Inverted Bucket Traps will handle large amounts of air, the hookups shown here provide thermal air vents for practically instantaneous heating. Use of Strong anti-balancing traps, guaranteed for a year against leakage, insures positive drainage without waste of steam.



Strong 70-T trap with built-in bi-metal air vent. For saturated steam pressures to 150 p.s.i.

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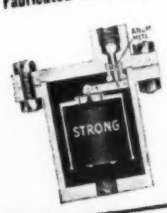

Inverted Bucket Traps

P-54

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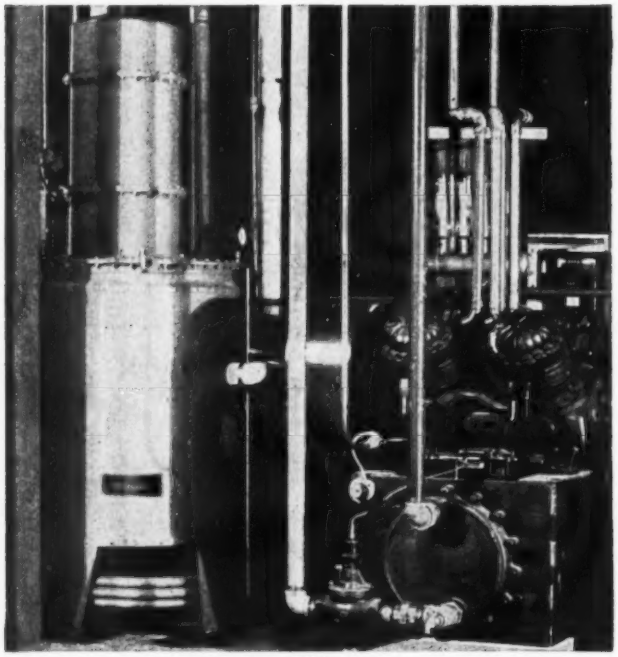

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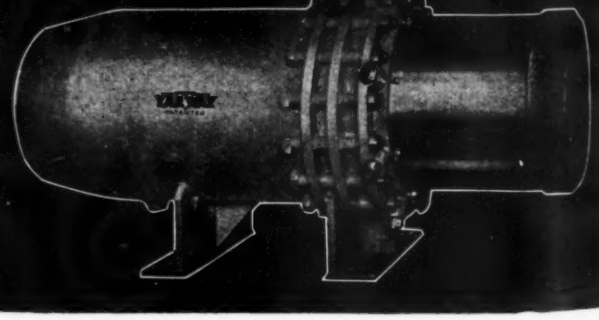

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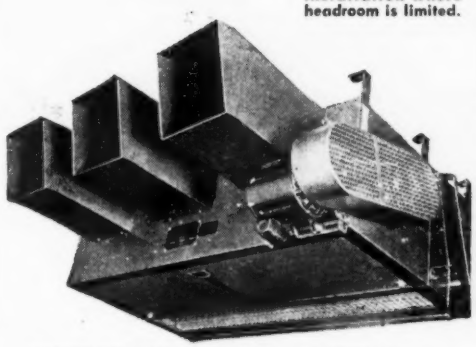

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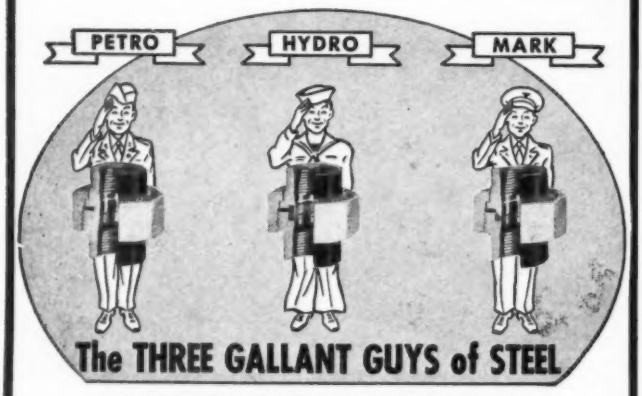

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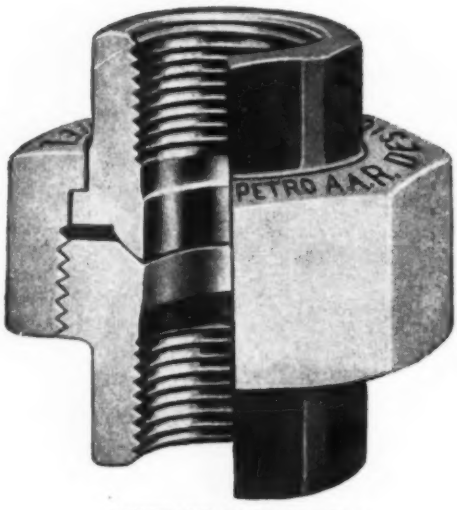

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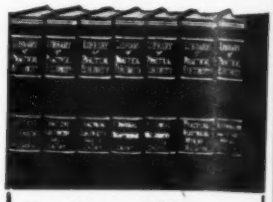

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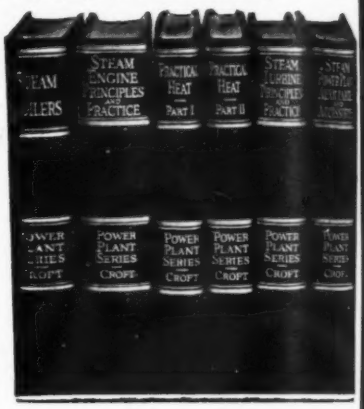

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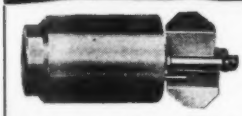

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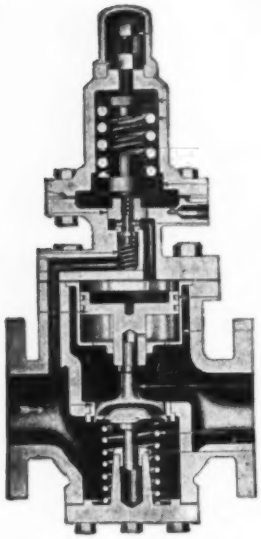

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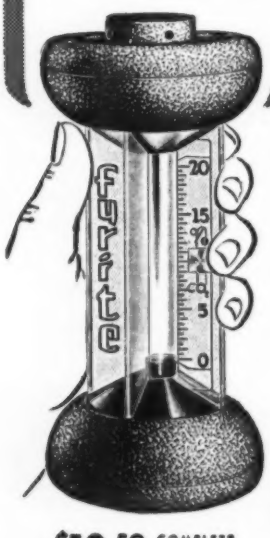

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OXYGEN ANALYZER designed on same principle available soon. Write for particulars.

$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

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RETURN THIS COUPON FOR BULLETIN 340 *on FYRITE "Orsat". Also learn how to get immediate delivery under priority regulations.*

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The ECONOMY SCV PUMP

. . . vertical design for easy mounting!

Compact . . . easy to install . . . permits efficient use of available space. Vertical design also permits motor to be mounted high above base; thus, motor is protected from dirt, splash and sweepings. Shaft is kept in perfect alignment.

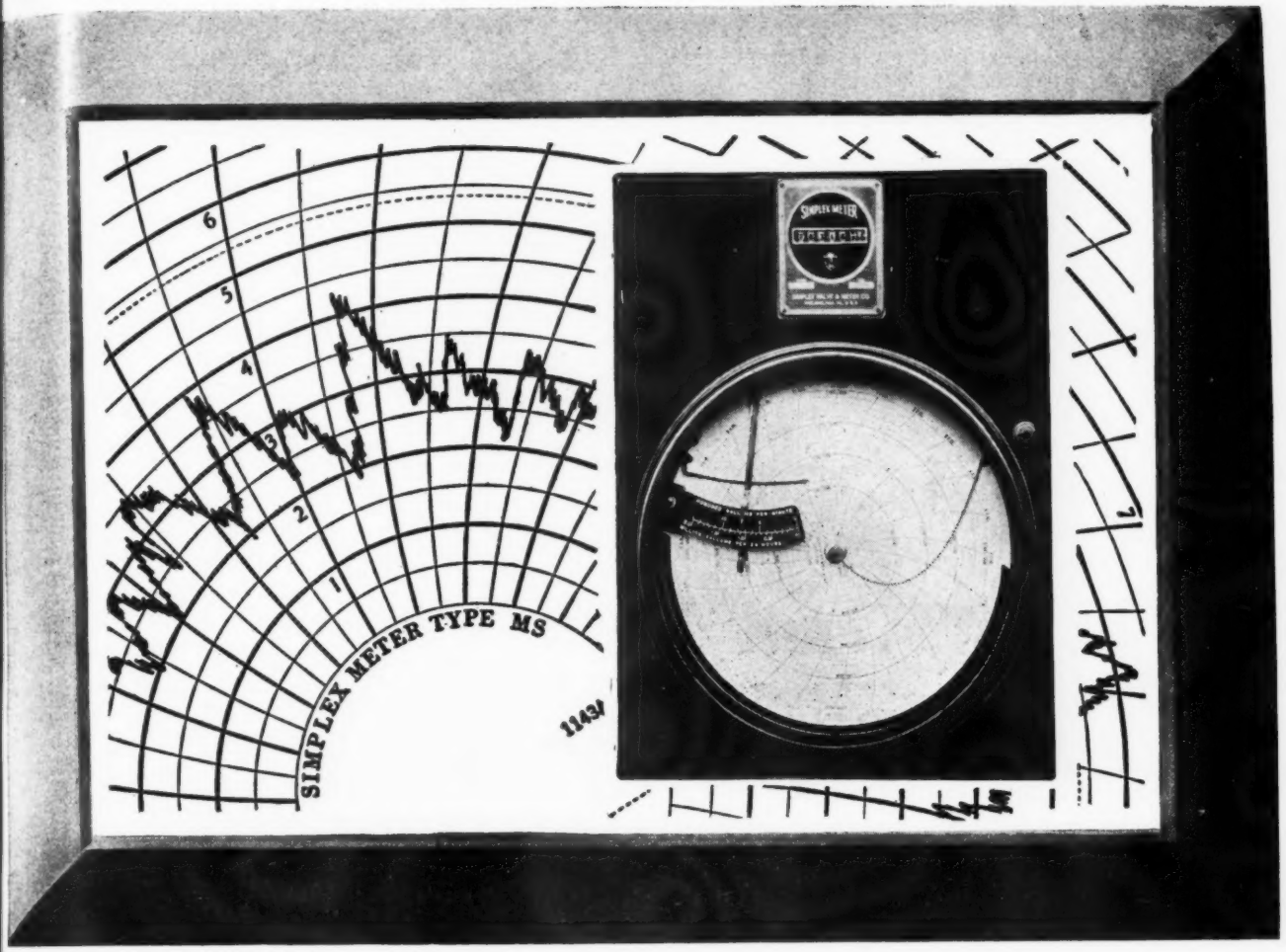
Specifications

ECONOMY SCV Pumps are built in sizes from 1" to 3" discharges . . . capacities from 10 to 500 G.P.M. . . . heads up to 225 feet. Adaptable to many services, including cold or hot water circulation, boiler feeding, pressure boosting, refrigeration service, washing equipment, air conditioning systems etc.

Write today . . . get your free copy of our catalog D2-1042 . . . fully describes and illustrates the new ECONOMY SCV Pump.

ECONOMY PUMPS INC.

1020 WELLER AVE. **HAMILTON, OHIO**



Portrait of A STEAM SLEUTH

What are the facts about steam that can save you dollars — conserve your manpower — increase operating efficiency?

The surest FACT FINDER is a Simplex MS Flow Meter on your steam lines, because it puts the finger of suspicion on defective equipment, relative quality of fuel, efficiency of the operating staff — and gives recorded flow rate data — the basis for effective control.

What are the reasons for the high accuracy of the MS Meter which makes it ideal for power plant use?

(1) The bell shaped float moves in direct proportion to the rate of flow.

(2) The direct reading, evenly spaced chart assures the same high accuracy and visibility of readings over the entire flow range.

(3) 7 digit totalizer simplifies integrating of flow and adds weeks of continually increasing daily computations before counter returns to zero. The seventh digit is a means of closely checking the flow.

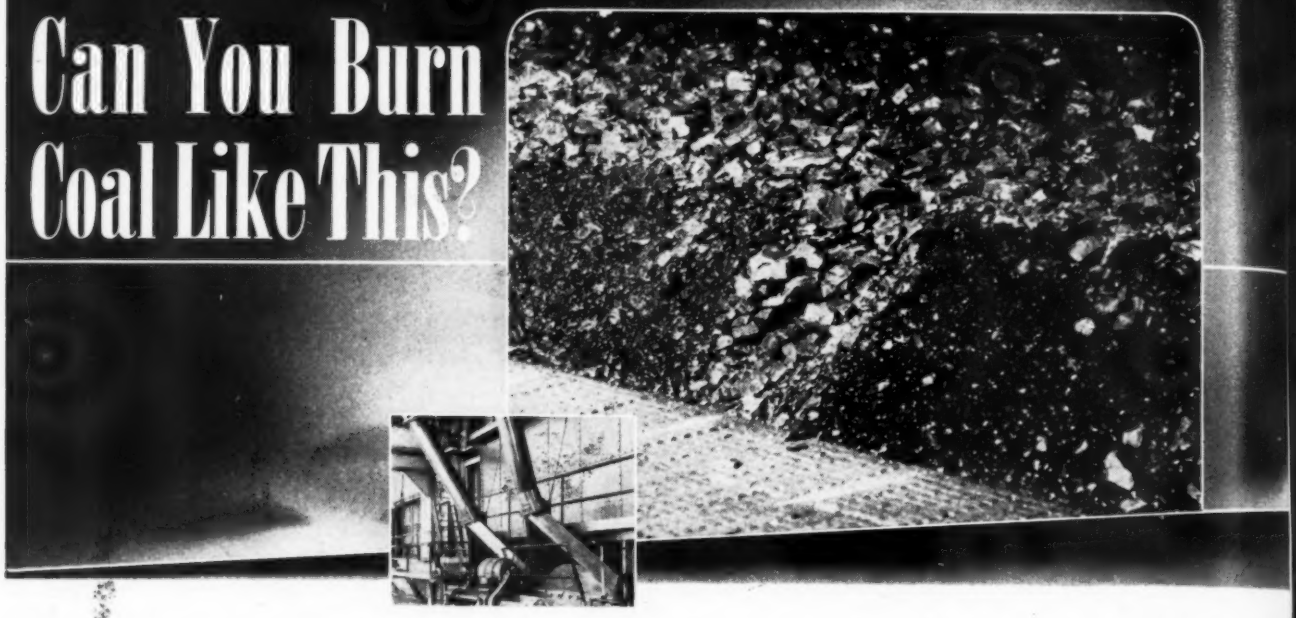
(4) Moisture-proof chart paper eliminates errors resulting from stretching and shrinking.

(5) The MS meter integrates, records, totalizes — in any desired combination. Remote reading also is available.

Put the facts about your steam flow to work for you. Write today for information on the Simplex MS Flow Rate Meter.

SIMPLEX VALVE & METER COMPANY
6780 UPLAND STREET, PHILADELPHIA, PENNA.

Can You Burn Coal Like This?



● Can you burn coal segregated as shown above? Note the coarse streak about 6" wide. This situation will cause deterioration of the arch immediately above. CO_2 will be low . . . combustible and ash will be high. The solution of this problem to install CONICAL Non-Segregating Coal Distributors. Why not run some coal on your stoker without burning it and see if you are getting the distribution that you should? A CONICAL Distributor as illustrated is the answer. Write today for complete information on CONICAL Non-Segregating Coal Distributors. Address Stock Engineering Company, 9807 Theodore Avenue, Cleveland, Ohio.

CONICAL Non-Segregating Coal Distributors ★ **STOCK** ENGINEERING CO. ★ S.E.Co. Coal Valves and Coal Scales

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BUILT

WE ARE GEAR SPECIALISTS
WE CAN SERVE YOU BETTER

SPUR · BEVEL · MITRE · SPIRAL HELICAL
INTERNAL AND WORM GEARS
ANY MATERIAL—ANY QUANTITY
GENERATED TOOTH RACKS · CUT SPROCKETS
PRECISION SURFACE GRINDING

Industrial
Cut Gears
Cut Sprockets

"CHICAGO'S FASTEST GROWING GEAR SHOP"

INDUSTRIAL GEAR MFG. CO.
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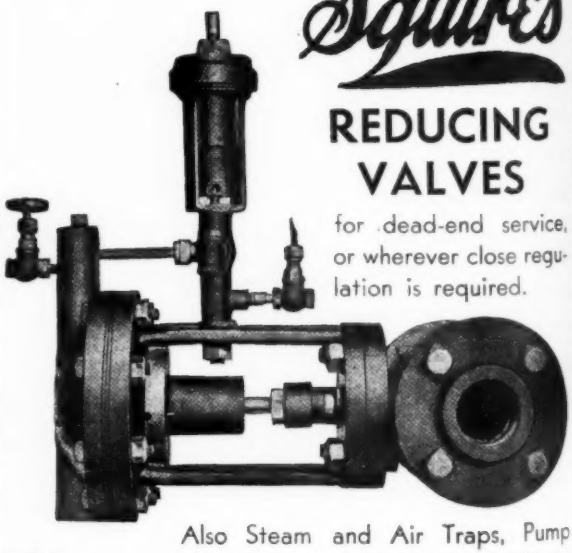
THE GENUINE
Squires
REDUCING
VALVES

for dead-end service, or wherever close regulation is required.



Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

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● Infilco Water Conditioning Equipment can prevent the tragedies of boiler shut-downs, interrupted production, lost manhours, damage to vital power plant equipment and waste of precious fuel.

And—conditioning water against scale, corrosion, embrittlement, carry-over and oil—will pay for itself while speeding the war effort.

You are invited to make full use of Infilco's 49 years experience. Call on our engineers to help you in any problem of boiler or evaporator feedwater treatment, condensate oil removal, cooling water conditioning, or steam purification.

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SEARCHLIGHT SECTION

WANTED

Grade A quality Steam Turbine Design Project Engineer with experience background in Navy and Commercial field applications. Excellent post-war opportunities with concern located in central New England.

P-570, Power
330 West 42nd St., New York 18, N. Y.

POSITIONS VACANT

BOILER INSPECTOR TRAINEE. Wanted by high class Insurance Company. Technical background desirable; practical experience in operation, maintenance or construction of high-pressure boilers necessary; ability to write comprehensive reports essential. Our employees know of this advertisement. Applicants must be non-essential work or otherwise comply with War Manpower Commission. P-556, Power 330 W. 42nd St., New York, 18. N. Y.

WANTED: Man as feed water analyst and assistant to superintendent of the University heating plant. State age, qualifications, and least salary in first letter to: University of Idaho, Heating Plant, Moscow, Idaho.

WANTED: By manufacturing company, technical man capable of preparing operation manual for portable power stations. Will receive assistance of expert electrical and steam engineers. Salary $300-$400 monthly. Length of job about one year. P-574, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: Assistant superintendent by public utility for large steam electric generating plant in the Southeast. Must be technical graduate and have ability to handle personnel. Opportunity for advancement for experienced, capable man. Address: P-575, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER PLANT ENGINEER with Practical operating experience to operate a small powered coal fired steam plant generating electric power. Permanent position for right party. Location Central New York. Give complete particulars, salary desired and when available in application. P-576, Power, 330 W. 42nd St., New York 18, N. Y.

POWER PLANT CHEMIST—$2400 to $3000 per year, Midwest location. Experience in coal and water analysis required. Furnish references and draft classification. P-577, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: Man experienced in steam generation and personnel matters as assistant superintendent of production for large public utility in the Southeast. Must be technical graduate. Experienced, capable man will find opportunity for advancement. Address: P-578, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: Operating Engineer to assume full charge of maintenance and operation of pumping plant in drainage district comprising 13,000 acres. Prefer married man near 50. Hand fired high pressure steam boilers, Worthington Pumps. Year around salary regardless of days pumping. Large 2 story brick house, barn, chicken house, fuel, furnished. Located on banks of Mississippi. Leisure time dependent on rains and river stage. Attractive proposition. Prefer previous experience in Drainage District Plant with similar equipment. Must be conscientious, steady, and of moderate habits. Write full details previous experience, references, salary expected. Enclose snapshot. P.O. Box 869, Davenport, Iowa.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R W. Bixby, Inc., 279 Delward Bldg., Buffalo, N. Y.

WANTED

Grade A quality Thrust Bearing Design Project Engineer with experience background in Navy and Commercial field applications. Excellent post-war opportunities with concern located in central New England.

P-571, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Grade A quality Speed Reducer Design Project Engineer with experience background in Navy and Commercial field applications. Excellent post-war opportunities with concern located in central New England.

P-572, Power
330 West 42nd St., New York 18, N. Y.

POSITIONS WANTED

CHIEF ENGINEER, (41) 22 years' experience operating steam engines and turbines, oil and coal-fired high-pressure boilers, refrigerating and air-conditioning equipment in stationary and marine power plants. Machine-shop experience. Available on one month's notice. PW-566, Power 330 W. 42nd St., New York, 18. N. Y.

POWER ENGINEER, technical training and 22 years experience in all phases of Power Plant Work just completed starting up a large new Plant and training personnel, age 44, good health. PW-582, Power, 520 N. Michigan Ave., Chicago 11, Ill.

BUSINESS OPPORTUNITY

MANUFACTURING RIGHTS WANTED—Independent manufacturer with complete engineering and research staff, production facilities, and international industrial sales organization wishes to develop new markets and products, particularly steam plant or allied process apparatus and in instrument and control fields. Write brief letter. BO-539, Power, 330 W. 42nd St., New York, 18. N. Y.

WANTED

WANTED: Used electrical equipment in good operating condition. Transformers: 100 KVA and smaller 480-120/240 volts, 60 cycle, either single or 3 phase. Cable: 1000 MCM, 750 MCM, and 500 MCM stranded copper cable insulated for 600 volts or over. W-579, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED STEAM ENGINE, 100 to 160 horse power at 100 pounds steam pressure. Modern economical type. Medium to high speed. Give maker, type; give engine speed, condition, age, etc. Write Box 987, Equity, 113 West 42nd, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

EXECUTIVE CONSULTING SALES ENGINEER desires connection with manufacturer of chemicals for water treatment. Several years experience in sales, sales-promotion, sales-engineering and manufacture. Ability to direct salesman with guaranteed results. At present am serving as consulting engineer for many of the largest industrials in the United States. Have national industrial following also sales-engineers working under my jurisdiction. Not interested in selling boiler feed water compounds in limited territory. Manufacturer must have products accepted for high pressure power plants. Address all communications to Sales Engineer SW-581, Power, 330 W. 42nd St., New York 18, N. Y.

MACHINERY WANTED

One or two engine-driven direct-connected generators, 220 volt, 3 phase, 60 cycle, 125 KW complete with switchboard equipment, voltage regulators, oil and steam separators. Steam condition 125 lb. saturated. 2 lbs. back pressure.

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39 Damrell St., South Boston, Mass.

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ARE YOU PARTICULAR?
DO YOU HAVE A SPECIAL MOTOR?
We stock only the Best of Insulation
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Previous Experience with
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Reconditioned, Tested and Guaranteed

Gate Valves for sale, Large stock, sizes 16" to 2", flanged end and screw end. Various pressures.

Stock List and Prices on Request.

THE GATE VALVE SHOP
120 Tuke Box 1936 Pampa, Texas

FOR SALE

1—750 KW GE turbo-generator, 3/60/2300/3600, condensing.
2—500 KW GE turbines, 3/60/2300/3600, condensing.
1—300 KW Allis-Chalmers turbine, 3/60/2300/3600, condensing.
1—300 KW Westinghouse, 3/60/220/3600 turbine, non-condensing.
1—300 KW Allis-Chalmers 3/60/240/150 engine generator, direct connected to Ridgway generator.
1—250 KW 3/60/440/120 Bullock generator direct connected to right-hand Filer & Stowell engine.

RALPH H. ROGERS & CO.
306 Millsaps Bldg., Jackson (106), Mississippi

FOR SALE

300 h.p. G.E. Synchronous Motor, 4160 volts, 3 phase, 60 cycle, 360 R.P.M. Complete with panel and controls—excellent condition.

W. K. GEAREN
501 N. LaSalle Indianapolis, Ind.

FOR SALE

BOILER

100 HP Boiler, Scotch Marine type, with shaker grates, complete with water column, safety valve, etc.

FS-573, Power
330 West 42nd St., New York 18, N. Y.

WANTED

150-500 BOILERS—GENERATORS. H.P. Code stamped boilers.

FOR SALE

UNIFLOW Engine-Generator 600 K. W. with
Boiler 500 H.P. 250# pressure.
Boiler 4—250 H.P. Heine 200# pressure.
Boiler 4—300 H.P. Veght 250# pressure.

H. A. WOODWORTH
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TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
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Large Woodworking Plant Machinery, Power Plant & Electric Equipment

Consisting of the Following:

Ames 700 H.P. Uniflow heavy duty Steam Engine with 400 K.W. G.E. generator, 3 phase 60 cycles, 250 volts. 1250 Amps. 150 R.P.M. including exciter and panel board.
Nagle Corliss Steam Engine, 225 H.P. including generator A.C. 60 cycles.
Terry Steam Turbine Type G. A. 195 lbs. pressure with 112½ K.V.A. Allis Chalmers A.C. Generator with panel board.
General Electric K.W. D.C. Generator type ATB—12-250-600-240 volts., 800 R.P.M.
60 K.W. Louis Allis Frequency changer Type H. Form A, 3 phase-60 cycles 220 to 440 volts., 1800 R.P.M.
15 General Electric Transformers size 15-50-75-100. Type H. Form K, 2300 to 220/110 volts.

Chicago Pneumatic 9" x 8" N.S.B. Simplate valve Air compressor with 30 H.P. AC Motor.

G.E. Static Condenser 60 K.V.A. Type C.B.T. Form A, 3 phase, 60 cycles, 220 volts.

Panel Board 15' long 7' high with a large quantity oil circuit breaker, knife, fused knife, speed control switches, watt hour, power factor, kilowatt, volt meters, frequency Indicators, Rheostats, Indicators, ammeter instrument transformers, copper bus bars with insulators.

Large quantity of power wiring, conduits, switch boxes, fuses, etc., throughout buildings and power house.

300 Amp 2500 T.P. oil circuit breaker and panel.

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Office, 225 Lafayette Street, New York City Tel. Canal 6-7820—7821

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DO YOU NEED LARGE LOW HEAD PUMPS?

We offer the following Allis Chalmers vertical centrifugal direct connected motor driven units:

#1. Type L. S. Size 42 x 36 48,000 GPM 31 ft. Hd. 319 RPM with 500 HP 2200 volt 3 phase 60 cycle motor.

#2. Type L. S. Size 42 x 36 48,000 GPM 31 ft. Hd. 319 RPM with 2 speed 2200 volt 3 phase 60 cycle motor 319/234 RPM.

#3. Type L. S. Size 42 x 36 35,000 GPM 31 ft. Hd. 350 RPM with 2 speeds 2200 volt 3 phase 60 cycle motor 350/248 RPM.

FS-552, Power
520 No. Michigan Ave., Chicago, Ill.

STOKERS

Two—Four Retort Riley Self-Dumping Underfeed Stokers

One—6 ft. Sturtevant, single width steel plate fan

One—7"x6" Troy Vertical enclosed Steam Engine

Metal & Thermit Corporation
Carteret, New Jersey

FOR SALE

STOKER

Illinois Forced Draft Chain Grate Stoker, with All Accessories, Suitable for burning bituminous coal 150 sq. ft. grate surface, drive 10 H.P. coupled to Reeves drive. No. 8 American Forced Draft Fan for 5¼ x 6 American Blower, engine included. Also Cochrane Open Type Boiler Feed Water Heater of approximately 25 H.P. and equipped with trays.

FS-562, Power
330 W. 42nd St., New York 18, N. Y.

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PLUMBING SUPPLY CO., INC
Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquid and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
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250 Volt Rebuilt Units

Direct Current

1—35 K.W. 250 volt 160 amp. 325 RPM. with 10" x 8" **VERTICAL** automatic engine.

1—15 K.W. 250 volt 68 amp. 400 RPM. direct connected to 7 x 7 **VERTICAL** automatic engine.

Units suitable for steam pressure 125/150 lbs. All of B. F. Sturtevant manufacture.

Write FS-580, Power
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FOR SALE: 2—90 HP HRT boilers. 1—80 HP HRT boiler with stoker stack and boiler feed pump. 2—150 HP HRT boilers with stoker and boiler feed pumps. Refrigerating Machinery, compressors, absorption, condensers, receivers, cranes, agitators, can fillers, extra heavy and standard bent ammonia coils. 1—each duplex and turbine driven centrifugal pumps 1000 GPM, other equipment. 180 H.P. FM Diesel Engine.

Parke Pettegrew & Son Company
370 West Broad Street Columbus, Ohio

FOR SALE CHEAP

3 Gas Engines—2 Winton, 1 automatic, 125 H.P. each; also one Cassey-Hodges Water tube boiler. All needing some repairs. Located in Corpus Christi, Texas.

Jones Investment Company
3710 Commerce St., Dallas, Texas

ELECTRICAL POWER EQUIPMENT

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW (2) WESTINGHOUSE 225-285 volts D. C., 225 RPM, with 13200 volt transformers

2500 KW (2) WESTINGHOUSE 310/245 volts D.C., 469 RPM with 13200/208 volt transformers

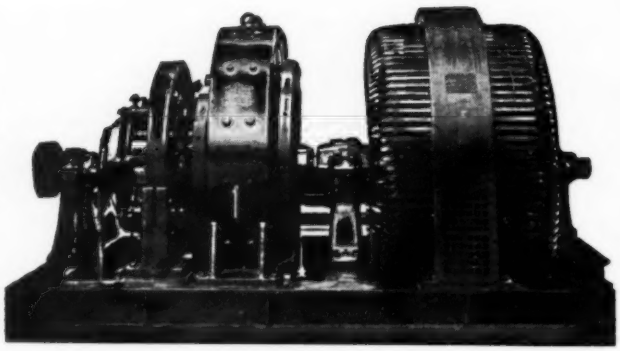
1700 KW (2) GENERAL ELECTRIC 250 volts D.C., 514 RPM

1500 KW WESTINGHOUSE 225-285 volts D. C. 450 RPM, with 2300/4000-6900/12000 volt transformers

1150 KW GENERAL ELECTRIC 250 volts D.C., 720 RPM

1000 KW WESTINGHOUSE 250 volts D. C., 600 RPM with 22000 volt transformer

750 KW GENERAL ELECTRIC 600 volts D. C., 1200 RPM, with 2300/4000 volt transformers



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1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MOTOR GENERATOR SETS

3 phase 60 cycle

1000 KW GENERAL ELECTRIC synchronous 125/250 volts 3 wire D. C., 13200/6600 volts A. C., 720 RPM

1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D. C., 4000, 2300 volts A. C., 720 RPM

500 KW GENERAL ELECTRIC synchronous 700 volts D. C. 4150 volts A.C. 720 RPM

MOTORS

3 phase 60 cycle 2200 volts

625 HP GENERAL ELECTRIC type TS form EJ 180 RPM synchronous

350 HP FAIRBANKS-MORSE type HV 600 RPM slip ring

300 HP WESTINGHOUSE type CW 490 RPM slip ring

Steam Turbo Generators

3 phase 60 cycle

7500 KVA GENERAL ELECTRIC noncondensing, 425 lbs. 750° TT, 200-250 lbs. back pressure, 13800 volts

3750 KVA GENERAL ELECTRIC 200 lbs. 2300/4000Y volts with surface condenser.

3125 KVA GENERAL ELECTRIC 225/400 lbs. 2400/4160 volts, with surface condenser

2500 KVA WESTINGHOUSE 200 lbs., 600 volts with jet condenser

1875 KVA GENERAL ELECTRIC 150 lbs. 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS 150/200 lbs. 2300 volts with jet condenser

625 KVA (2) ALLIS-CHALMERS KERR non-condensing, 90 lbs. 10 lbs. back pressure, 480 volts

SURFACE CONDENSER

1540 sq.ft. WORTHINGTON surface condenser with steam jet air pumps

Steam Engine Generators

3 phase 60 cycle

500 KVA GENERAL ELECTRIC Ames uniflow, 175 lbs., 5 lbs. back pressure, 240 volts

500 KVA ALLIS CHALMERS Corliss, 175 lbs. 25 lbs. back pressure, 240/480 volts

438 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure, 240/480/2300 volts

300 KVA GENERAL ELECTRIC-AMES twin uniflow, 175 lbs. 10 lbs. back pressure 240/480 volts

210 KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs. 5 lbs. back pressure 240/480/2300 volts

STEAM ENGINE GENERATORS

250 Volts D.C.

500 KW CROCKER WHEELER AMES, 4 cylinder vertical uniflow, 150 lbs., 5 lbs. back pressure 250 volts

Diesel Engine Generators

3 phase 60 cycle

333 KVA GENERAL ELECTRIC DE LAVERGNE 4 cylinder 2300 volts, 225 RPM

250 KVA CROCKER WHEELER WORTHINGTON 6 cylinder 208/120 volts 400 RPM

230 KVA GENERAL ELECTRIC WORTHINGTON 4-cylinder, 440 volts, 327 RPM

225 KVA WESTINGHOUSE-WORTHINGTON 3-cylinder, 2300 volts, 275 RPM

200 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

187 KVA GENERAL ELECTRIC McINTOSH - SEYMOUR 4 cylinder, 2300 volts, 257 RPM

170 KVA FAIRBANKS-MORSE 4 cylinder 2400 volts, 257 RPM

125 KVA WESTERN ELECTRIC WORTHINGTON 2-cylinder, 2300 volts, 277 RPM

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD — CLEVELAND, OHIO

It's "Hemphill" for Electric Power

THAT'S THE BIG NEWS IN THE POWER EQUIPMENT FIELD!

It's simple as A-B-C. Hemphill *has* the Power Equipment you need—or can quickly get it for you. We make no "blue-sky" claims regarding our Service in this field. But there are, naturally, certain companies that can and do render *better* service than others—due to (1) stocks of equipment on hand and (2) knowledge of the field plus wide contacts. *Hemphill Service* cannot be excelled. We are equipped to recondition right here in our own shop motors from 1 H.P. to the largest motor generator sets, frequency changers, Rotary Converters and Transformers. You can confidently count upon us to deliver, *on time*, dependable Power Plant Equipment . . . with certainty of satisfaction. Put Hemphill *first* on your "sources of supply" list.

THE EQUIPMENT YOU *want*.. FOR THE POWER YOU *need*.. NOW

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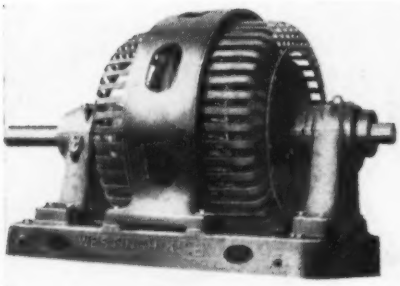
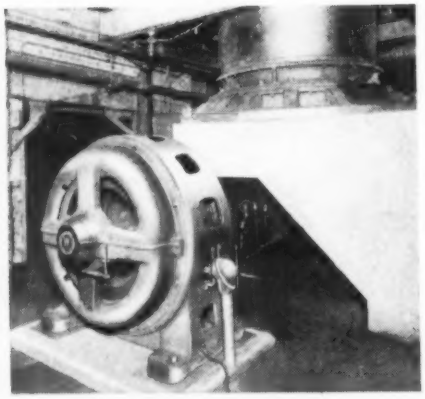
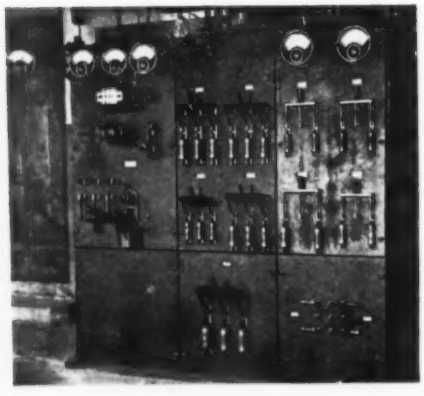
"HEMPHILL" BULLETIN

• HERE'S enormous of equipment







MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers synchronous
1—75 KW, 125 volt, Crocker-Wheeler synchronous
1—35 KW, 125 volt, Electric Machinery squirrel cage induction motor.
1—20 KW, 600 volt, General Electric squirrel cage induction motor.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chal.
1—62½ KVA, 3600 RPM, 220 volts, Allis Chal.
1—50 KW, 1200 RPM, 220 volts Burke

MOTORS

3 PHASE 60 CYCLE

1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.

PLATING GENERATOR SETS

1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle

D. C. MOTORS

230 VOLTS

2—450 HP, G.E., 400 RPM. Type MPL. Form 1-F.
2—150 HP, Westghse., 550 RPM, Type SK.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—125 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 900 RPM, 440, Westg., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, GE., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS

D.C. 230 VOLTS

1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker - Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague: with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.

J. L. HEMPHILL & CO.

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...power ready to use... in the shape ...for dependable service...

VARIABLE SPEED MOTORS

1—150 HP, Crocker Wheeler 350/1050 RPM.
1—35 HP, 500/1500 RPM, Westinghouse.

MOTORS—3 PHASE 60 CYCLE (Con't)

1—65 HP, G.E., 625 RPM, Type DLC-65. Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31D. Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-12. Form A.
2—20 HP, Westghse., 1700 RPM, Type SK.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, G.E., 6600/2200/220/440
3—200 KVA, G.E., 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghse., 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750—110/220 volts.
3—100 KVA, Westinghse., 13200 250 volts.
3—75 KVA, G.E., 13,500—750/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, Wagner, 4150—220 volts.

TRANSFORMERS (Cont'd)

2—50 KVA, Pbgh. 7500/15,000, volts—110/220 volts.
4—37½ KVA, 2200—220/110 v.
7—25 KVA, Westg., air cooled, 440/220—110 volts.
1—25 KVA, G.E., 220/110—220/110 volts.
2—15 KVA, G.E., 2300—115/2930 volts.

MOTORS—VARIABLE SPEED

230 VOLTS

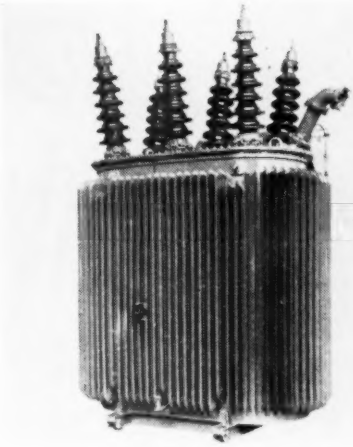
2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 350/1050 RPM, Electro Dynamic
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

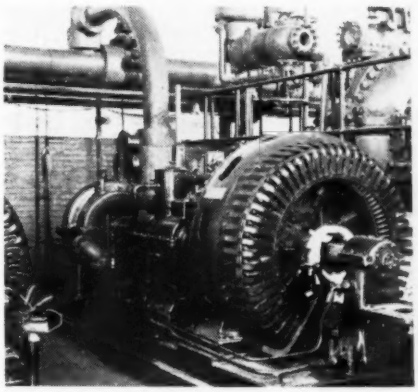
TURBO-GENERATORS

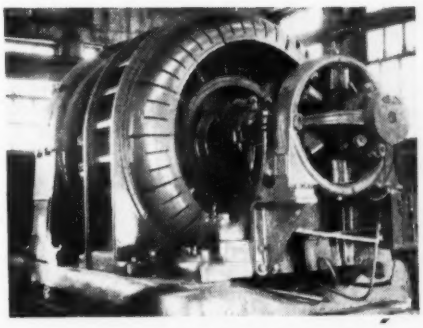
600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with split core, CT.
25—Westinghouse type U Recording Voltmeters.







Power Equipment

THIS FOLDER GIVES ANSWERS TO PRODUCTION PROBLEMS

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We have just finished printing an illustrated folder to show you why you can buy with confidence from The O'Brien Machinery Company • We've crammed it full of pictures that tell, better than words, that O'Brien is no "desk broker!" • We show you our plant, our warehouse, our rebuilding shops, the assembly and testing departments. • And there are many pictures of the types of machine tools and the power plant equipment that we rebuild, test and guarantee.

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MOTOR GENERATOR SETS

1000 K.W. G.E., 3 unit, 135/270 V, 1400 H.P., Synchronous 3/60/2300/514 RPM
750 K.W. G.E., 4 unit, 240/240/240/1200 RPM, 1200 HP Synchronous 3/60/2300
500 K.W. G.E. MPC, 250 V, 700 KVA, 3/60/2300
250 K.W. G.E. MPC, 240 V, 1200 RPM, 3/60/2300
200 K.W. G.E. DLC, 240 V, 3/60/2300/720 RPM
200 K.W. Ridgway 250 V, 3/60/4000/900 RPM
150 K.W. Ridgway 250 V, 3/60/2300/900 RPM
100 K.W. G.E. Syn. Drive 250 V, 3/60/220/1200
100 K.W. West. 125 V, 3/60/2300 Sq. Cg.
75 K.W. G.E. Sq. Cg. 250 V, 3/60/2300
50 K.W. G.E. RC Syn. Drive 125 V, 3/60/220/1200 RPM
50 KVA G.E. 3/60/220 75 H.P. Drive 125 V.
50 K.W. West. 150 V, Syn. Drive 3/60/220
50 K.W. G.E. 125 V, Sq. Cg. 3/60/2300/720 RPM
35 K.W. Fairbanks-Morse 240 V, Syn. Dr. 3/60/220
10 K.W. Crocker Wheeler Balancer 125 V
5 K.W. G.E. 125 V, 3/60/220/1800 RPM

STEAM ENGINE GENERATOR SETS

Alternating Current

1000 KVA West.—Skinner Uniflow 3/60/440
750 KVA G.E.—Skinner Uniflow 3/60/2300
400 KVA Allis-Chalmers Corliss 3/60/480
375 KVA West.—Skinner Uniflow 3/60/440
325 KVA G.E.—Chuse Uniflow 3/60/220/2300
300 KVA G.E.—Ames Uniflow 3/60/480
210 KVA G.E.—Skinner Uniflow 3/60/480
200 KVA Allis-Chalmers—Ames Uniflow 3/60/240
187 KVA G.E.—Chuse Uniflow 3/60/240
125 KVA G.E.—Chuse 4 valve 3/60/240
50 KVA West.—Harrisburg Automatic 3/60/220/2300

STEAM TURBINE GENERATOR SETS

Condensing—A.C.

1—4000 KVA Allis Chalmers 3/60/2300/3600 RPM
1—3125 KVA Gen. Elec. 3/60/2300/3600 RPM
1—1500 KVA Westinghouse 3/60/2300/3600 RPM
1—1250 KVA Gen. Elec. 2/60/2300/3600 RPM
1—937 KVA Gen. Elec. 3/60/2300/3600 RPM
3—625 KVA Allis-Chalmers 3/60/2300/3600 RPM
1—625 KVA Gen. Elec. 2/60/2300/3600 RPM
1—500 KVA West. Geared, 3/60/2400/6000—900 RPM
3—500 KVA Gen. Elect. Bleeder 3/60/220/3600 RPM
1—250 KVA Worthington Moore Bleeder 3/60/220
1—187 KVA Westinghouse geared 3/60/2300
1—150 KVA Westinghouse 3/60/240/3600 RPM

Non-Condensing—A.C.

1—625 KVA Westinghouse geared 3/60/2300
1—625 KVA Allis-Chalmers 3/60/240/3600 RPM
1—500 KVA G.E.—Terry 3/60/120/208/3600 RPM New
1—500 KVA Westinghouse geared 3/60/480 New
1—375 KVA Westinghouse geared 3/60/2300
1—375 KVA Allis Chalmers 3/60/240/3600 RPM
1—125 KVA Al. Ch.—Kerr 2/60/220/3600 RPM
1—75 KVA Allis-Chalmers 3/60/240/3600 RPM

A. S. M. E. BOILERS

1—500 H.P. Keeler-Wetzel Stoker, 160 lbs.
1—400 H.P. Babcock Wilcox W.T. 200 lb. W.P.
1—300 H.P. Brady Scotch Marine 15 lb.
2—300 H.P. Heine non code, 160 lb.
2—250 H.P. Union Water Tube—Taylor Stokers
2—250 H.P. International self-contained, 200 lbs.
1—200 L.P. Coatesville H.R.T. 150 lbs.
1—100 H.P. Babcock & Wilcox W.T. 350 lb. W.P.

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

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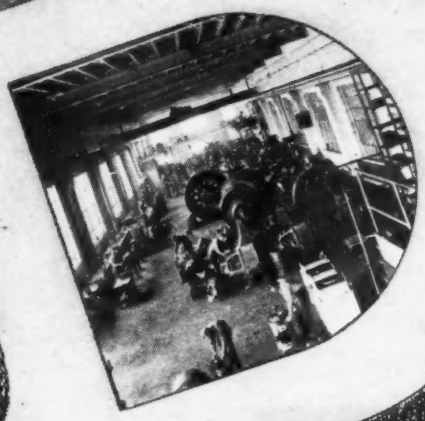
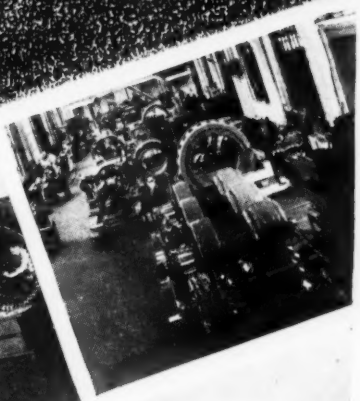
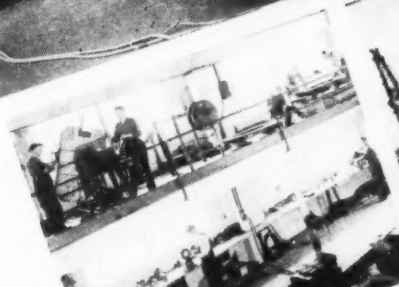
"BELYEA" RE-NU-BILT





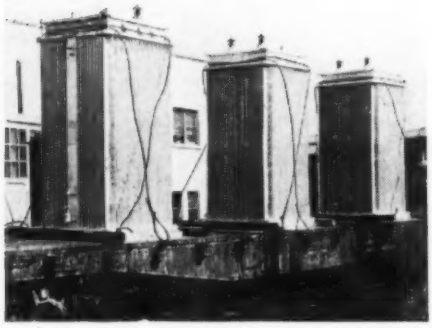


WE HAVE WHAT IT TAKES FOR WHAT YOU WANT

We present on this page views of the Belyea shops and warehouse where Belyea Epuipment is *Re-Nu-Bilt* to render the service you expect from new equipment. In the Belyea shops we are equipped to make the most exacting *tests* of used equipment to detect electrical faults or flaws—and then to remove such parts and rebuild, or replace, as the job may demand. *We prefer to eliminate faults in the Belyea shops—not have them develop in yours.* It is service such as this that has built the Belyea reputation, the reputation that *protects* our customers.

THE NEXT 2 PAGES LIST SOME OF THE EQUIPMENT AVAILABLE FROM OUR JERSEY CITY STOCK

It's "BELYEA" because of...



TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
6—1667	Pitts.	1	OISC	13200x2300
1—1050	G.E.	3	WCTH	11000x445/222
4— 525	G.E.	1	HJ-DD	2300x445
3— 400	Whse.	1	S	2400x440
2— 333	Whse.	1	OISC	2300x460
2— 333	Pitts.	1	OISC	2400x220
1— 300	Pitts.	3	OISC	4150x208/120
3— 300	Pack.	1	OISC	2300x460/230
3— 300	G.E.	1	H	13200x2300/575
3— 200	G.E.	1	HILD	26400x115/460
2— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SK	2200x440/220
3— 150	Whse.	1	SKM	2400x120/240
6— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250
3— 75	Whse.	1	SK	6600x440/220
4— 75	Pitts.	1	OISC	2300x575
3— 50	Maloney	1	HE	11000x2300
3— 50	G.E.	1	H	13800x230/115
2— 50	Whse.	1	SA	2200x440/220

A. C. GENERATORS AND SYNC. MOTORS

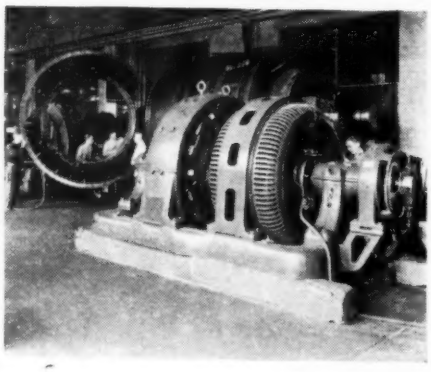
3 Phase—60 Cycle

HP or KVA	Make	Type	Volts	Speed
1—1000	G.E.		2300	900
1— 625	Whse.		480	900
1— 500	G.E.	TS	440	360
1— 250	G.E.	ATB	2300	600
1— 250	G.E.	ATI	220	450
1— 225	G.E.	ATB	220	600
1— 159	Whse.		2400	900
1— 150	Whse.		4000	1800
1— 100	Whse.		2400	900
2— 100	Whse.		2300	1800

MOTOR GENERATOR SETS

3 Phase—60 Cycle

1—1500 KW G.E., 600 V. D.C. to 2100 H.P. 6600 V.
1—1000 KW G.E., 250 V. D.C. to 1400 H.P. 13200/2300 V.
1—500 KW 3 unit consisting of 2—250 KW G.E., 250 V., d.c., to 1—700 HP, 2300 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
1—500 KW G.E., 600 V. D.C. to 700 H.P. 2200 V.
1—500 KW G.E., 250 V. D.C. to 1000 KVA. 2300 V. Syn. Motor.
1—400 KW G.E., 250/275 V. D.C. to 600 H.P. 2300 V.
1—300 KW G.E. 250/275 V. D.C. to 450 KVA, 4000/2300 V.
1—250 KW Cr Wh. 230 V. D.C. to 450 KVA. 2300/4000 V. Syn. Motor.
1—100 KW WHSE., 250 V. D.C. to 159 KVA, 2300 V.
1—100 KW WHSE., 250 V. D.C. to 175 H.P. sl. rg. 2200 V.
1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
2—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.
1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.
1—35 KW A. B. See 230 V. D.C. to 50 H.P. sq. cg. 220 V. with exciter.



MILL TYPE

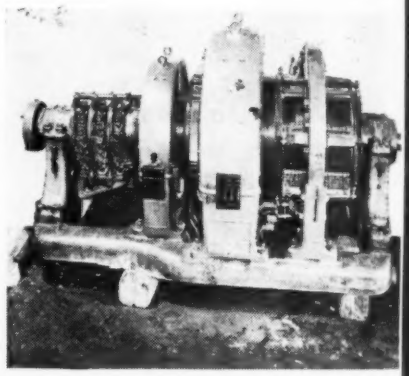
D. C. Motors

1—MD—102BB—Comp. 550/1100 RPM. 230 V.
6—MD—104BB—Comp. 400/800 RPM. 230 V.
1—MD—104AA—Comp. 400/800 RPM. 230 V.
5—MD—103AA—Series 800 RPM. 230 V.
4—MD—103AA—Comp. 900 RPM. 230 V.
2—MD—104½AA—Series 500/700 RPM 550 V.
2—MC—80B—Comp. 350/700 RPM. 230 V.
1—MCA—20—Series 700 RPM. 230 V.

CRANE TYPE

DC Motor

HP	Make	Type	RPM	Volts
12— 2½	Whse.	K	965	550
1— 1	G.E.	CO-1803	750	230
2— 5	G.E.	CO-1804B	725	230
1— 20	Cr. Wh.	SM-BW	575	230
2—125	G.E.	CO-1832	625	230



ROTARY CONVERTERS

3 Phase—60 Cycle

1—1500 KW Whse., 720 RPM., D.C. 600 V. A.C. 11500 V.
1—1500 KW Whse., 600 RPM., D.C. 600 V. A.C. 11500
1—1250 KW G.E., HCC, 720 RPM., D.C. 250 V. A.C. 2300 V.
1—1000 KW Whse., 900 RPM., D.C. 600 V. A.C. [illegible]/2300 V.
2—750 KW Whse., 1200 RPM., D.C. 600 V. A.C. 5500/2300 V.
1—750 KW Whse., 900 RPM., D.C. 600 V. A.C. 6600/2200 V.
1—500 KW Whse., 900 RPM., D.C. 250 V. A.C. 2300 V.
1—500 KW Whse., 1200 RPM., D.C. 600 V. A.C. 2300 V.
2—375 KW Whse., 1200 RPM., D.C. 250 V. A.C. 2300 V.
3—300 KW G.E., 1200 RPM., D.C. 600 V. A.C. 2300 V.
1—250 KW Whse., 1200 RPM., D.C. 250 V. A.C. 2300/4000 V.

Rotary Converters

3 Phase 25 Cycles—Booster Type

2—1500 KW G.E., HCC, 500 RPM., D.C. 225/275 V. 6000 Amp., A.C. 13200/6600 V.
1—500 KW G.E., HCC, 750 RPM., D.C. 225/275 V. 2000 Amp., A.C. 6600 V.

Special

TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.

1—500 KW G.E. 625 Kva. 2300 V. 3 ph. 60 cy. with Curtis 4-stage 150 lb. cond. turbine with cond. and access.

RE-NU-BILT BELYEA MOTORS

Experience and Reputation

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

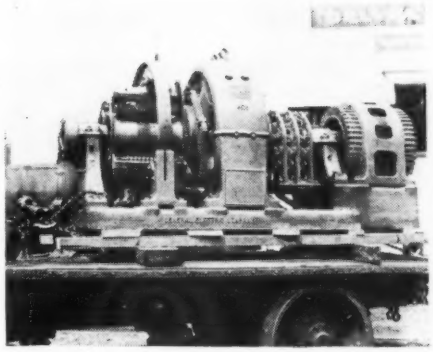
HP	Make	Type	Volts	Speed
1—1200	Cr. Wh.	801Q	2300	237
1— 800	Al. Ch.	ANY	440	885
1— 800	Whse.	CW	440	357
1— 600	G.E.	IM	440	900
1— 450	Whse.	HW	2200	875
1— 400	Al. Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	IM	440	720
1— 300	Whse.	CW	440	585
1— 250	G.E.	MT	4000/2300	257
1— 200	G.E.	IE-M	2200	1750
1— 200	Whse.	CW	2200	514
1— 200	G.E.	I-M	440	600
1— 175	G.E.	IE-M	2200	880
1— 150	G.E.	IM	2200	695
1— 150	G.E.	MT-564	440	600
1— 150	G.E.	IM-17B	2200	290
1— 100	G.E.	1M	220	1750
1— 100	G.E.	MTC	191	860
1— 100	G.E.	1M	550	720
1— 90	Wagner	BR	220/440	650
1— 80	G.E.	MTC-542	440	850
1— 75	F.M.	BY	2200	1750
1— 75	Whse.	CW-865A	440	900
1— 75	G.E.	1M-14	440	575
1— 60	G.E.	MT-333	440	1750
1— 50	Whse.	CW	440	1200
1— 50	G.E.	MIS-105	220	1200
1— 50	Whse.	CW-658A	220	870
1— 50	Whse.	MW-334A	440	580
1— 40	Harnis.	WT-130	220	720
1— 40	G.E.	MT-352	440	575
1— 40	G.E.	MT-536	2200	860
1— 40	G.E.	MT-532	2200	1200

A. C. MOTORS

3 Phase—60 Cycle

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	1-17B	2200	690
1—400	Whse.	CS-1104A	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—250	Al. Ch.		220/440	1150
1—200	G.E.	IK	2200	490
1—200	Whse.	CS	4600	900
1—150	Al. Ch.	AN	440	1765
1—100	Whse.	CS	550	1750
1—100	G.E.	IK	220/440	685
1—100	G.E.	IK	2300	450
1— 75	G.E.	IK	2200	900
1— 75	Whse.	CS	550	700
1—60-20	Al. Ch.	AR	2200	850/420
1— 50	G.E.	KT	550	900
1— 50	G.E.	KT-552	2200	575
1— 40	Whse.	CS-644C	440	870
1— 40	G.E.	H1-12	220	570



D C MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	330
1—1250	G.E.	MCF	250	650
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
2— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MCF	230	400/1000
2— 300	G.E.	DMC	230	400/600
1— 300	Cr. Wh.	CMC 102H	230	1150
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
1— 250	Al. Ch.	Irt	230	525
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/525
6— 150	G.E.	RC-19	230	800/1000
1— 150	G.E.	MPC	230	250/450
1— 150	Whse.	SK	230	300/900
2— 120	Whse.	SK	230	720
1— 100	Al. Ch.		230	950/1150
3— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
2— 100	G.E.	RC-19	230	575/720
3— 100	Whse.	SK-183	230	560/780
1— 75	G.E.	C	230	500/1000
4— 60	Diehl	K-11	230	500/1000
2— 60	Cr. Wh.	CMC-65H	230	500/1000
1— 60	El. Dy.	25S	230	525/1050
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
1— 50	G.E.	RC	230	400/1200
1— 45	G.E.	RC-13	230	1200
1— 45	Cr. Wh.	CCM-65H	230	400/800
1— 40	Cr. Wh.	CMC	230	600/1200
1— 40	G.E.	CD-103	230	1150
1— 40	Al. Ch.	E-131	230	850
1— 40	Rel.	310T	230	625
1— 40	G.E.	RC-34	550	875
15— 30	Whse.	SA	230	500/1500

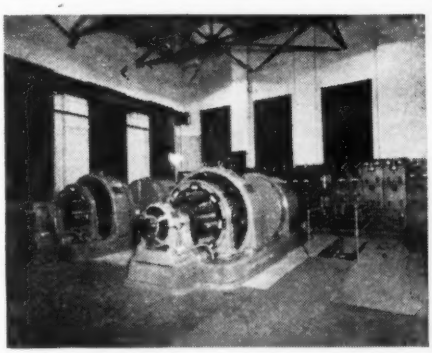
D C GENERATORS

Quan.	Kw.	Make	Volts	RPM	Type
1	1000	G.E.	250	720	MCF
1	500	G.E.	600	900	MCF
1	500	G.E.	600	720	MPC
1	500	Al. Ch.	250	600	
1	500	Whse.	250	167	
1	300	G.E.	250	1800	CC
1	300	G.E.	250	525	MPC
1	200	Al. Ch.	250	580	
2	175	Whse.	250	450	SK
1	165	G.E.	300	375	MPC
1	150	G.E.	575	1200	MPC
1	150	Whse.	550	750	SK-210
1	150	G.E.	125	200	MPC-LD
2	140	G.E.	80	950	MPC
1	100	G.E.	250	1200	RC-37
3	100	Whse.	250	900	SK-180
2	100	Whse.	240	250	No. Brg.

GEAR REDUCTION UNITS

1—2100 H.P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 750 H.P. Al. Ch. 3600/600 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

We Also Have Large Variety of Oil and Air Circuit Breakers both Manual and Solenoid operated—Let us have list of your Needs.



RE-NU-BILT means Reliability

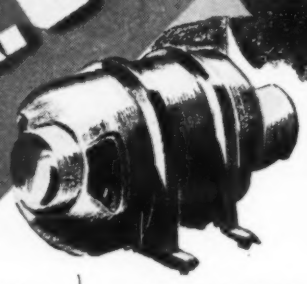
BELYEA COMPANY, INC.

Main Office and Shop: **43 HOWELL ST., JERSEY CITY, N. J.**

RE-NU-BILT BELYEA MOTORS

A.C. MOTORS

"Land" guarantees, One Year!



3 PHASE SQUIRREL CAGE

H.P.	Make	Speed
200	G. E.	600
150	G. E.	1750
150	West.	1170
147	West. 25 cyc.	715
100	Cr. Wh.	1750
100	G. E.	1160
100	G. E.	870
100	West.	690 (2)
100	G. E.	580
100	G. E. (BTA)	375/750 (2)
75	West.	870
50	West.	1160
50	G. E.	690
50	Cr. Wh.	490
40	El. Dy.	1150
40	G. E.	870
40	Triumph	690
35	Wagner	850
30	El. Dy.	3600
30	U. S. (Vert.)	3450
30	West. (Vert.)	1750
30	Watson 25 cy.	1450
30	Al. Ch.	850
30	El. Dy.	680
30	Al. Ch.	580
30	G. E.	490
25	G. E.	1150
25	Wagner	1150
25	El. Dy.	1150
25	West.	1140
25	Wagner	1160
25	Diehl	865 (4)
25	West.	870
25	G.E.	870
25	G. E. 25 cy.	750
25	Wagner	720
25	Westing.	700
20	El. Dy.	1150
20	Al. Ch.	1750
20	G. E.	1750 (2)
20	G. E.	1150
20	G. E. Vert.	1150 (2)
20	F. M.	1150
20	Cr. Wh.	1150

3 PHASE SQUIRREL CAGE—Continued

H.P.	Make	Speed
20	West.	1140
20	Al. Ch.	860 (4)
20	F. M.	870
20	Diehl	865 (3)
20	G. E.	870
20	G. E.	690
20	R. & M.	690
20	West.	690
15	G. E.	3600
15	Burke	1800
15	G. E.	1750 (1)
15	Cr. Wh.	1720
15	G. E.	1160
15	Al. Ch.	1160 (3)
15	Cr. Wh.	1140
15	G. E.	1120
15	G. E. Vert.	1150
15	G. E. Vert.	870
15	West.	850
15	Al. Ch. 25 cy.	750
15	Wagner	720
15	Watson 25 cy.	750
15	G.E.	580
14½	G. E.	980
12	G. E.	690 (8)
10	G. E.	3450
10	El. Dy.	1150
10	Al. Ch.	1150 (2)
10	West.	1120
10	G. E. Vert.	870
7½	Al. Ch.	1750
7½	R. & M.	1750
7½	G. E.	1640
7½	West. 25 cy.	1460
7½	G. E.	1150
7½	West.	1130
7½	West.	970
7½	G. E.	870
7½/3¾	G. E.	1800/900
6	G. E. Vert.	6/9/12/1800
5	West.	1700
5	G. E. (BTA)	550/1650
5	West.	1150
5	G. E.	1150
5	West.	840 (2)
3	El. Dy. Vert.	1750 (2)
3	Ideal Vert.	1750 (2)
3	Wagner Vert.	1140
3	G. E.	400
3	G. E. Vert.	1150
3	G. E. Vert.	1160
3	West. 25 cy.	1160
3	Master 25 cy.	710
3	G. E. 25 cy.	286
3	Steri. vert.	190
3	Steri. Vert.	110
2½	West.	1020
2	G. E.	3600
2	Louis Allis	1150

3 PHASE SQUIRREL CAGE—Continued

H.P.	Make	Speed
2	G. E.	1150
1½	G. E.	6/9/12/1800
1½	G. E.	3500 (5)
1½	El. Dy.	3600
1½	El. Dy.	1800 (2)
1½	Master	1800
1½	Wagner 25 cy.	1450
1½	El. Sp.	1150 (3)
1½	G. E.	12/900 (4)
1	G. E.	3600
1	G. E.	1800
1	Watson	1720
1	G. E. Vert.	1710
1	Del.Ver.25 cy.	1435 (2)
1	Diehl	1140 (3)
1	Ideal	1150
1	G. E.	12/900 (10)
1	G. E.	6/9/12/1800
1	Master 25 cy.	321

2 PHASE SQUIRREL CAGE

H.P.	Make	Speed
75	Cr. Wh.	870
50	Line.	870
50	G. E.	870
50	Al. Ch.	870
40	G. E.	870
40	Al. Ch.	870
40	F. M.	870
40	Cr. Wh.	870
35	Al. Ch.	870
30	West.	1150
25	G. E.	1150 (3)
25	West.	1150
20	El. Dy.	1750 (2)
20	West.	1160
20	Star	1150
15	West.	3450
15	West.	1150
15	G. E.	1150
15	Cr. Wh.	1140
15	F. M.	870
10	West.	1150
10	G. E.	1150
10	El. Dy.	1140
10	G. E.	870 (2)
7½	G. E.	865
7½	G. E. (BQS)	600/1350 (2)
5½	G. E.	870
5	G. E. 25 cy.	1500
5	West.	1130
5	Al. Ch.	1140
3	West.	870
2	West.	1130
1¾	L. All.	
1½	G. E.	1800
1	West.	1700 (2)
1	Cr. Wh.	1700
1	G. E.	1150
1	Howell	870
½	Hobart	1700
½	Kimball	1750
½	Cr. Wh.	1150
½	Star	1750
¼	El. Sp.	3400 (8)
¼	Wing	1150
¼	G. E.	1140
¼	G. E.	1200 (3)
¼	G. E.	1725

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
500	Al. Ch.	1180
250	G. E.	600
200	West.	580
200	G. E.	495
150	Al. Ch.	695
125	West.	1175
125	Burke	580
112	G. E.	690
100	F. M.	690
79	West.	1170
75	West.	1170
75	Al. Ch.	575
64	G. E.	585
60	West.	1135
60	West.	290
50	Ideal Vert.	1740
50	G. E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870 (2)
40	West.	870
40	Line.	690
30	G. E.	870
30	G. E.	690
15/35	West.	6/1200 (5)
25/55	G. E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	Burke	870
25	West.	850
25	Howell	870
25	G. E.	870 (2)
25	G. E.	720
25	West.	575
20	G. E.	870
20	West.	575
15	G. E.	845
10½	G. E.	780
10	G. E.	1150
10	Al. Ch.	1150
7½	Triumph	850
7½	G. E.	870 (2)
7½	Howell	720
5	Wagner	1140
5	G. E.	1150
5	G. E.	870
5	Northern	1090
3	West.	1160
3	G. E.	870
3	West.	870
2	G. E.	870
1½	G. E.	1150 (12)
1½	West.	1140 (12)
1½	West.	870
1½/3	El. Dy.	6/1200
1	Kimball	1150
1	G. E.	1150 (6)

SPECIAL
500 H.P. AL. CH.
Slip Ring, 3 ph.
2300 V, 1180 RPM.

SYNCHRONOUS MOTORS

H.P.	Make	Speed
50	Cr. Wh.	1800

550 V. DC.

H.P.	Make	Speed
25	G. E.	875
20	G. E.	895
15	G. E.	1350
7½	G. E.	900
3¾	G. E.	5/1650
3	G. E.	1800
1½	G. E.	1750 (2)
1½	G. E.	500/1575
1	G. E.	7/1500
½	Eck	1600
½	G. E.	6/1875
¼	G. E.	1400

230 V. DC.

H.P.	Make	Speed
330	G. E.	1100
150	West.	600
60	Roth	600
60	G. E.	480/1100 (2)
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G. E.	560
50	G. E.	850
45	Diehl	850/1020
45	G. E.	1800
40	G. E.	975
40	Cr. Wh.	915
40	P. & H.	Hoist
35	West.	1150
35	G. E.	440/800
30	West.	975
30	West.	1025
30	West.	500/1500
25	Diehl	850/1020
25	G. E.	1150
25	Al. Ch.	1150
25	Rel.	850
25	G. E.	700
25	G. E.	575
20	Cr. Wh.	1750
20	G. E.	1200/1600
20	R. & M.	1160
20	G. E.	1150 (4)
20	West.	1150 (2)
20	West.	975
20	G. E.	800
20	Al. Ch.	625
19	West.	1300 (2)
17½	Spr.	750
15	Star	1450
15	West.	1250
15	G. E.	1250
15	G. E.	1150 (5)
15	Eck	1100
15	Cr. Wh.	900/1800
15	West.	8/1600
15	West. Sk.	750
13	Nat.	1100
10	G. E.	850 (3)
10	West.	850 (3)
10	G. E.	700
10	Diehl	750
10	West.	600/1200
10	G. E.	400/1600
10	West.	400/1200
9	L. All.	1750
8½	Diehl	900

NEW YORK CITY'S LARGEST STOCK OF ELECTRICAL MACHINERY

L.J. LAND AND

D.C.

O.P.A. guarantee only 90 days

230 V. DC.—Continued

H.P.	Make	Speed
8½	West.	850
8½	West.	350/1400
8	Cr. Wh.	910
8	G. E.	500/1500
7½	G. E.	Crane
7½	L. All.	Baier
7½	Sturt.	3600
7½	Peerless	1750 (2)
7½	West.	1450
7½	G. E.	1150 (2)
7½	West.	1150 (4)
7½	West.	975
7½	Cr. Wh.	900
7½	West.	850
7½	Al. Ch.	850 (3)
7½	Niles	Hoist
7½	El. Dy.	5/1650
7¼	Watson	5/1150
7½	G. E.	450/1800
7½	G. E.	400/1600
7½	Al. Ch.	350/1050
7½	G. E.	3/1200
6	G. E.	400/1600
6	Roth	1150
6	G. E.	850
6	G. E.	450/1800 (2)
5¾	West.	850
5½	West.	500/1500
5½	G. E.	Hoist
5½	G. E.	900
5½	G. E.	400/1600
5½	West.	500/1500
5	West.	1700
5	G. E.	1700 (2)
5	Rel.	1750
5	G. E.	1650 (2)
5	G. E.	1150 (9)
5	West.	1100
5	All. Ch.	1150
5	Cr. Wh.	1000
5	West.	870/1750
5	Cr. Wh.	960 (4)
5	Spr.	950
5	West.	850 (2)
5	G. E.	850
5	Cont.	600/1800
5	Star	600/1200
5	El. Dy.	550/1650
5	G. E.	500/1000
5	G.E.	450/1800
5	Northern	425/1275
5	G. E.	600
5	G. E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G. E.	850/1150
4	Diehl	1150
4	Northern	Hoist
4	Cr. Wh.	780 (2)
3½	Cr. Wh.	Hoist
3½	West.	975
3½	West.	850/1600
3½	West.	850 (2)
3½	Diehl	550
3½	El. Dy.	485
3	Watson	1750
3	G. E.	1750 (6)
3	West.	1750
3	R. & M.	1750
3	Star	1750
3	Spr.	1350
3	G. E.	1150
3	G. E.	1150 (6)
3	West.	1150 (4)
3	Cr. Wh.	1050
3	Master	1150
3	Star	1150
3	G. E.	850
3	Spr.	650
3	Roth	500/2200
3	G. E.	5/1500 (2)

230 V. DC.—Continued

H.P.	Make	Speed
2¾	West.	9/1800
2½	Watson	1300
2½	Diehl	7/1400
2½	West.	480/1800
2	G. E.	2500
2	R. & M.	2200
2	Watson	1800 (2)
2	R. & M.	1750
2	West.	1750
2	Rel.	1750
2	Diehl	1725
2	Burke	1700
2	Watson	1600
2	Cr. Wh.	1600
2	Spr.	1600
2	Cr. Wh.	1250
2	West.	1180
2	Watson	1150
2	Cr. Wh.	1150
2	G. E.	1150
2	Star	900 (2)
2	West.	850 (8)
2	Spr.	700/1400 (2)
2	Rel.	400/1200 (4)
1.8	Cr. Wh.	460 (2)
1½	G. E.	1700 (5)
1½	Watson	1750
1½	Roth	12/2400
1½	Cr. Wh.	1250
1½	El. Dy.	1200
1½	West.	1140
1½	Cr. Wh.	950
1½	West.	900 (3)
1½	Sturt.	850
1½	Diehl	800
1½	West.	260/1000
1¼	Cr. Wh.	550
1.2	Cr. Wh.	1175
1.1	Cr. Wh.	500 (2)
1	Eck	2400
1	Watson	1800
1	West.	1700
1	Cr. Wh.	1675
1	Eck	1450
1	West.	1140 (2)
1	Cr. Wh.	1335
1	N. Wst.	1300 (6)
1	G. E.	1275
1	G. E.	1150 (2)
1	Cr. Wh.	1200 (2)
1	Watson	900
1	G. E.	850
1	G. E.	575/1725
1	El. Dy.	600
1	C. & C.	520
1	Diehl	470
1	G. E.	450
1	Rel.	54

115 V. DC.

H.P.	Make	Speed
90	G. E.	900
20	West.	400/900
15	West.	1100
15	Cr. Wh.	800
10	L. All.	3500
10	G. E.	1150 (3)
10	West.	850
10	El. Dy.	425/1275
7½	West.	975
7½	G. E.	850 (2)
7½	Cr. Wh.	900
6	Burke	650
5	Cr. Wh.	1875 (2)
5	G. E.	1750
5	Col.	1500
5	West.	1100 (2)
5	Cr. Wh.	960
5	Cr. Wh.	600/1800
5	J. & L.	300/1200

115 V. DC.—Continued

H.P.	Make	Speed
4	R. & M.	1600
4	Cr. Wh.	535/1070 (2)
3¼	Diehl	475
3	West.	1725
3	G. E.	1550
3	G. E.	1150 (6)
3	West.	1150 (2)
3	G. E.	700/1200
3	Cr. Wh.	625
3	G. E.	500/1500
2½	Eck	1150
2½	N. E.	850
2½	Diehl	850
2½	G. E.	450
2	G. E.	1750 (2)
2	Spr.	1150 (3)
2	West.	1200 (2)
2	Cr. Wh.	1150 (4)
2	G. E.	1150 (2)
2	Diehl	1125
2	G. E.	850
2	Eck	550/1050
2	Watson	525
2	A. L.	375
1½	G. E.	3400
1½	N. W.	3600
1½	G. E.	1700
1½	West.	1725 (2)
1½	West.	1250
1½	Al. Ch.	500/1500
1½	G. E.	900
1½	Rel.	600/1800
1	G. E.	3400
1	Burke	2200
1	G. E.	1700 (2)
1	Cr. Wh.	1750
1	R. & M.	1750
1	Del.	1750
1	Cr. Wh.	1675 (2)
1	G. E.	850 (3)
1	G. E.	585
1	Diehl	450
1	G. E.	275
½	E. N. T.	2400
½	Spr.	1450 (2)
½	G. E.	1350 (2)
½	G. E.	1140
½	Emer.	850
¾	R. & M.	3500
¼		1750 (8)
¼	G. E.	1650

LOW VOLT. GEN.

KW	Make	Volt
3	Wotton	93
4	Hertner	90
1½	Line.	88
8.4	G. E.	70
2	Roth	70
5	Imperial	70
1¼	G. E.	65
1½	G. E.	60
5	Hohlberg	55
5½	G. E.	50
4	Hohlberg	40
94	G. E.	60
48	West.	60
48	West.	30
9/10	H-C	25
10	West.	25
2	G. E.	16
1	West.	15
1	G. E.	12½
3/10	Ideal	12
1/2	H-C	10
1/8	Eager	7½
1-1/8	Roth	7½
5.1/2	Cr. Wh.	7
1	H. V. W.	6

375/3000 V. DC. GEN.

KW	Make	Voltage
200	West.	600
60	G. E.	600
40	G. E.	1000
30	El. Dy.	600
20	G. E.	600
12½	West.	375
10½	G. E.	1500
5½	Eck	1500
5	G. E.	500
4	G. E.	400
3	Cont.	2000
2½	El. Spec.	2000
2¼	G. E.	2000
2½	G. E.	3000
2½	G. E.	1600
2	R. & M.	1600
2	R. & M.	400
2	G. E.	400
2	Burke	2000
1.7	G. E.	2000
1	G. E.	1000
1	El. Sp.	1000
1	G. E.	500
1	Cont.	500
1	H-C	400
7/10	El. Sp.	1000
½	G. E.	500
½	West.	500
4/10	R. & M.	375
1/10	G. E.	500

250 V. DC. GEN.

KW	Make	Speed
100	West.	900
45	West.	700
25	G. E.	1750
15	West.	1750
15	G. E.	1200
4	El. Dy.	1400
1½	Al. Ch.	1750
1½	Bogue	850
1¼	Diehl	2100
¾	Watson	1500
½	G. E.	1800
¼	Roth	1200

LOW VOLT. MOTORS

1/20 R. & M. 24 V
1/4 West. 32 V
3/4 Roth 32 V.
1½ G. E. 70 V.
1.9 G. E. 75 V

A. C. GENERATORS

KW	Make	Speed
200	G. E.	600
150	G. E.	900
100	West.	600
18	G. E.	1800

BUFFERS

5 H. P. B & D 230 volts D. C.

125 V. DC. GEN.

KW	Make	Speed
125	G. E.	2400
40	Cr. Wh.	1800
40	West.	690
35	G. E.	1500
25	West.	1800
25	G. E.	1100
21	G. E.	1500
20	G. E.	650
18	Conn.	925
15	West.	1750
15	Cr. Wh.	1150
13.8	West.	1400
15	Roth	900
15	West.	1125
13	G. E.	690
12½	West.	875
12	G. E.	1800
10	G. E.	1450
9	El. Mchy.	790
7½	Ideal	1800
7½	West.	1450
6	G. E.	1750
5	G. E.	900
2.6	Cr. Wh.	3600
1½	G. E.	1200
1	Diehl	1000
½	G. E.	1800

WELDERS

Size	Make	Drive
400 amp.	West.	D. C.
300 amp.	Wilson	D. C.

HOISTS

Size	Hoist	Drive
5 ton	P. & H.	A. C.
2 ton	Link-Belt	D. C.
2 ton	G. E.	D. C.
1½ ton	G. E.	A. C.
1 ton	Shepherd	D. C.
1 ton	Yale	A. C.
¼ ton	American	

AIR COMPRESSORS

12½x12	American
3½x6	Worthington

BLOWERS

Size	Make	Press.
3000	CFM I-R.	1½ lb.
3200	CFM I-R.	1 lb.
2 #16	Roto Clones	Type W
1 #12	Roto Clone	Type W
3—12x17	Needham	Rotary

BALANCING SETS

2—15 KW Star
1—65 amp. G. E.
1—100 amp. Cr. Wh.

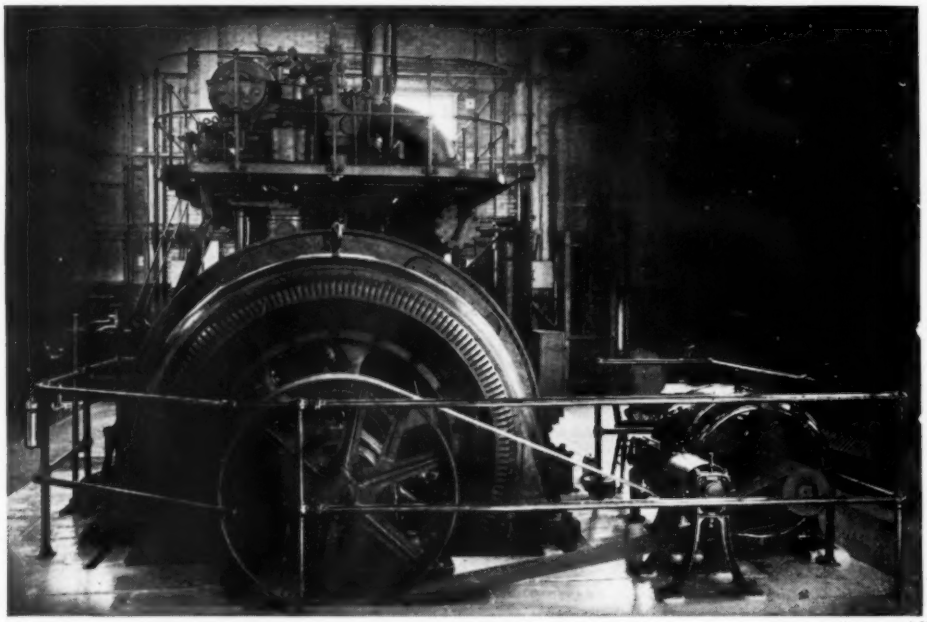
OMPANY

146 GRAND STREET • CANAL 6-6976 • NEW YORK 13, N. Y.

All equipment rebuilt in our own shops

READING, PA.—10th & Exeter St. • YORK, PA.—323 East Market St.

450 KVA DIESEL ENGINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

450 KVA General Electric; 2 or 3 phase, 60 cycle, 2300/550/440 volts, 200 RPM alternating current generator direct connected to Busch-Sulzer vertical full Diesel engine complete with auxiliaries. A#1 operative condition—still on original foundation for operating test.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

7500 KVA Westinghouse condensing 200 lb. pressure, 2300 volts, 1800 RPM complete with either surface or jet condenser.

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser.

3125 KVA—2500 KW 80% P.F., G.E. 2300 volts, 3600 RPM, 180-200 lbs. pressure, 500 degree total temperature, equipped with surface condenser, condensing auxiliaries, panels and instruments. A complete installation.

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 6600 volts, 3600 RPM complete with condenser.

937 KVA Allis condensing 150-200 lb. pressure, 475° T.T., 2300 volts, 3600 RPM complete with direct connected exciter, surface condenser and auxiliaries.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA (2) G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

400 KW G.E. 125 volts, 165 RPM generator direct connected to a 26" x 28" Elliott Ridgway Unaflow non-condensing engine.

300 KW Westinghouse, 250 volts, 175 RPM generator direct connected to a 24" x 26" Skinner Unaflow non-condensing engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

438 KVA G.E. 480 volts, 200 RPM generator direct connected to a 23" x 24" Skinner Unaflow non-condensing engine, 125-160 lb. pressure, 5 lb. back pressure. Complete installation.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

210 KVA G.E. 480 volts, 225 RPM generator direct connected to Skinner Unaflow engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

100 KW Triumph 250 volt direct current generator direct connected to 150 HP, 3 phase, 60 cycle, 2300 volt, 900 RPM squirrel cage motor.

MOTORS

—3 phase, 60 cycle

1500 HP Allis-Chalmers, 2,300 volts, 200 RPM slip ring.

625 HP G.E. type ATI, 2,200 volts, 257 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volts, 164 RPM synchronous.

250 HP (2) G.E. form M, 440 volts, 450 RPM three-bearing slip ring.

150 HP (5) G.E. form K, 2200 volts, 580 RPM squirrel cage.

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1200 KVA G.E. 3 phase, 60 cycle, 2400 volts, 300 RPM alternating current generator direct connected to a 1700 HP, 3 phase, 25 cycle, 2300 volt synchronous motor.

MISCELLANEOUS

(Continued)

522 HP water tube boiler ASME code, 210 lb. pressure complete with stoker and accessories. New 1927.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

500 KVA Ideal, 3 phase, 60 cycle, 240 volt, 400 RPM belted generator with direct connected exciter.

330 KW G.E. synchronous rotary converter 600 volt direct current—6 phase, 60 cycle alternating current—1200 RPM with 2300 to 408 volt transformers.

200 KVA Westinghouse 3 phase, 60 cycle, 240 volt, 200 RPM engine type generator.

30 KW G.E. 125 volt, 625 RPM, type RC compound wound direct current generator.

1055 cu.ft. 100 lb. air pressure Chicago Pneumatic horizontal compressor direct connected to 170 HP, 240 volt, 150 RPM G.E. direct current motor.

SYNCHRONOUS CONDENSERS

1350 KVA Total Capacity

750 KVA and 600 KVA G.E. type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers each complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition—still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

1—200 kw. G. E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

1—300 kw. G. E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

500 kw. G.E. 250 v. D.C. 1200 rpm., 2300 v. 3 ph. Syn. Motor.

150 KW Ridgway 250 v. DC, 900 rpm. dir. con. 2300/3/60 syn. motor, complete.

1—150 kw. Crocker Wheeler 250 v. DC, 600 rpm. dir. con. to 220/440 or 2200 v. syn. motor.

125 kw. Cr. Wh. 250 v. D.C. 1200 rpm., 220/440 v. 3 ph. 60 cy. Ind.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 6 cy. dir. con. Ideal Steam.

1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm. dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva, G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

1—150 kva. Wagner 220/440 v. 3 ph. 60 cy. 600 rpm.

1—250 KW 480 V., 3/60, Allis-Chalmers, 150 rpm.

3—115 kva. West. 2300/3/60 900 rpm.

D.C. GENERATORS

1—750 KW. 250 v. D.C., 115 rpm., West.

A.C. MOTORS—3 ph. 60 cy.

Qu	HP	Make	Volts	Speed	Type
18	½	G. E.	220	900	K
33	½	G. E.	220	1140	K
19	1½	Ilg.	220	490	ball bearing
		(Totally enclosed)			
6	10	American	440	1200	PK
		(Enclosed—ball bearing)			
1	10	Allis Chal.	220	1200	
1	10	American	440	570	PK
		(Enclosed—ball bearing)			
3	10	G. E.	440	570	KT-322
11	10	G. E.	440	495	KT-332
9	15	Allis Chal.	440	1500	AN
1	15	Burke	220	1200	EM 1.2
1	15	Triumph	220	1150	
1	15	G. E.	440	900	I-K
1	15	G. E.	440	900	KT-322
2	15/30	West	220	550/1100	MS
		(Two speed induction Motor)			
1	15	Allis Chal.	440	860	ball bearing
1	15	G. E.	440	865	
2	15	Triumph	440	850	ball bearing
3	15	G. E.	440	690	KT
3	15	G. E.	440	575	KT-326
8	15	G. E.	220	570	KT-332
2	15	West.	220	550	MS
1	15	West.	440	450	CS
1	15/45	West.	440	450/850	CS
9	20	Allis Chal.	440	1800	AN
1	20	West.	220	1750	
1	20	Reliance	440	1200	
10	20	American	440	1200	PK
		(Enclosed ball bearing)			
1	20	G. E.	440	1200	KT
1	20	G. E.	440	875	
1	20	Triumph	220	900	TR 10-S
		(High torque)			

A.C. MOTORS—3 ph. 60 cy.—con.t

No.	HP	Make	Volts	RPM	Type
1	20	G. E.	220	900	
1	20	Allis Chal.	440	720	
9	20	G. E.	440	690	KT-332
1	20	West.	440	680	
2	25	West.	220	720	CS
1	30	G. E.	440	1200	KT-332
2	30	West.	220	1100	MS
1	30	Allis Chal.	220	900	
1	30	Allis Chal.	220	900	NR
1	30	Triumph	220	525	TR-138
1	35	G. E.	440	1200	I
1	35	Lincoln	220	720	
2	35	West.	220	514	CS
	30/36	G. E.	220	3600	KT-205y
1	35	Crocker Wh.	220	570	122Q
1	40	Allis Chal.	220	900	
1	40	G. E.	220	720	KT-346
1	40	Amer. Elec.	440	685	
		(Vertical ball bearing)			
2	40	Amer. Elec.	440	685	PK
		(Enclosed ball bearing)			
1	40	West.	220	600	CS
1	45	West.	440	850	CS
7	50	Allis Chal.	440	1800	AN
2	50	West.	440	1800	C
1	50	Crocker Wh.	220	1160	
1	50	West.	440	1120	C
1	50	G. E.	440	900	KT-342
1	50	G. E.	440	900	I-8
2	50	West. Elec.	440	870	
3	50	Wagner	440	850	
1	50	West.	440	850	CCL
1	50	West.	440	650	CCL
2	50	West.	220	600	CS-752C
1	50/100	West.	440	345/700	CS
1	54	Allis Chal.	440	900	
6	60	Allis Chal.	440	1800	AN
1	60	G. E.	440	1800	KT
1	60	West.	440	1800	C
1	60	G. E.	220	720	I-8
1	60	Crocker Wh.	220	670	122-Q
1	60	Triumph	220	430	
1	65	West.	440	1800	M
6	65	Allis Chal.	440	1800	AN
3	65	G.E.	440	1800	KT-347
1	75	Louis Allis	440	450/1725	DV-505y
		(Adjusto speed clutch motors—normal torque—low starting current, ball bearing, bema frames)			
1	75	G. E.	220	900	I-8
1	75	G. E.	440/550	720	I-10
1	75	Crocker Wh.	220	514	124Q
1	100	West.	220	1750	
1	100	G. E.	220	1200	I-8
1	100	Allis Chal.	220	600	
1	100	Crocker Wh.	220	575	124QB
1	100	G. E.	440	400	I-K
1	100	G. E.	440	200	syn
1	125	Wagner	440	1800	
1	125	G. E.	440	1800	I
1	125	Allis Chal.	440	1800	AN
1	125	Crocker Wh.	220	720	124QB
1	125	Allis Chal.	440	695	
1	150	Wagner	440	1800	
1	150	G. E.	440	1800	I-4
1	150	Allis Chal.	440	1800	AN
2	150	G. E.	440	600	I-K
1	150	G. E.	550	575	I-K
2	150	G. E.	550	514	I-K
1	150	G. E.	2200		
			220/400	450/243	
2	150	G. E.	440	200	syn
1	200	G. E.	2200	1800	KT
1	200	West.	2200	900	CS-967A
1	200	West.	220	580	CS
1	200	G. E.	220	514	I-K
4	200	Allis Chal.	2300	347	AN
4	250	Allis Chal.	2300	435	AN
1	260	West.	2200	450	syn
4	400	West.	2200/220/440	500	CS
1	1000	G. E.	2300	509	K

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	RPM
1	1500	Westg.	CW	2200	435
1	700	G. E.	MT-432	2200	393
1	400	Westg.	CW	440/220	1176
1	300	Westg.	CW-1106	2200	580
1	300	W. El.	I-12	440/220	600
1	250	Westg.	CW	2200	345
1	100	G. E.	I	220	450
1	100	Westg.	CI	220/440	1750
1	75	Cr. Wh.		220/440	875
1	60	Triumph	C-16	220/440	430
1	60	Westg.	HF	2200	690
1	53	G. E.	I	220/550	1165

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri.	Sec.	Make	Ph.
1	250	2300	460	G. E.	
1	150	2200	230/460	G. E.	3 ph.
1	100	2200	110/220	G. E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	8 ph
2	50	2300	220/440	G. E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G. E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West.(Rotary)	
1	30	2200	110/220	G. E.	
2	30	440	220/110	West.	
25	25	2200	110/220	G. E.	
3	15	2200	110/220	G. E.	
35	10	2200	110/220	G. E.	
40	10	2200	110/220	West.	
100	7½	2200	110/220	G. E.	
50	7½	2200	110/220	West.	
50	5	2200	110/220	G. E.	
75	5	2200	110/220	West.	

VARIABLE SPEED MOTORS—230 V. D.C.

No.	Hp.	Make	Type	RPM
1	35	West.	sk-140	675/1350
1	30	West.	sk-123	850/1700
1	30	G. E.	RLC	450/900
4	20	West.	sk-100L	750/1500
2	10	G. E.	le	625/1250
1	5	G. E.	CD-85	450/1800
2	3	Jantz Liest	BI	650/1950
3	2½	G. E.		500/1000
1	2	West.	SK-63	300/1800
1	2	West.	SK-23	700/2100
1	½	Northern		700/2100

25-30 cy. MOTORS 220/440 V. A.C.

Qu	HP	Make	Type	RPM
1	75	G. E.	I-4	900
1	75	Allis-Chalmers	AN	900
6	40	Allis-Chalmers	AN	900
1	35	Western Elec.	SL13B	500
1	35	West.	M	900
1	30	West.	C	720
7	30	Allis-Chalmers	AN	900
2	25	West.	MS	715
9	10	Allis-Chalmers	AN	900

SYNCHRONOUS MOTORS

2—150 HP, West. 2300/3/60 900 rpm 80% P.F.

DIESEL ENGINE GENERATOR SET

217 KVA, G.E. 2300/3/60 dir. con. 260 HP Buckeye 2 cyl. 200 rpm. semi-diesel engine, complete.

AIR COMPRESSORS

1—1400 cfm. Bury 2 low pres. cylinders 16 x 16—1 high pres. cyl. 14 x 14 100# pres. complete with 300 H.P. motor.

2—677 cfm Nat'l Brake 2 st. 100# with 150 HP. A.C. Cyn. Motors.

INDUSTRIAL TRUCKS

4 Automatic Lift Trucks 6000# with Ready Power Unit or Batteries.

1—Elwell Parker Tow Tractor 2000 lb. with batteries.

1—Baker Tow Truck with batteries.

PUMPS

1—2" gasoline driven portable Sterling Machy. Co.

CRANE

1—20 ton Whiting Crane 36'10" span motor driven lift, hand power.

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DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH, PA.

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

1—600 KVA West.—Booster transformer (Auto Transformer Type) 240/208 volts 60 cy. 3 ph.
3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
1—200 KVA Allis-Chal. 60 cy. 3 ph., 220/440.

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 rpm with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM, revolving field, built-in exciter.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 RPM.
50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

★400 H. P. SYNCHRONOUS MOTOR★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse. Syn. motor, 3 ph. 60 cy. 4000/2300 V. 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V. DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle, 750 speed, 220/230 volts. With Transformers for 2300 volts.

FREQUENCY CHANGERS

40 KW GE type I.T.T. frame 553 3 ph. 25/62. ½ cy 220 volts primary 440 volts secondary, 750 RPM direct con. to 40 H.P. GE type KT543—3 ph. 25 cy. 220 volt 750 RPM.

OTHERS IN ALL SIZES VOLTAGES AND CYCLES

3 ph. 60 cy. A. C. MOTORS

H.P.	Make	Type	Speed	Volts
300	Gen. Elec.	Sl. Rg. 1 Form M.	600	220/440
200	Wsghse.	Sl. Rg. CW	600	220/440
200	Gen. Elec.	Sq. Cg. 1 Form K	514	220/440
175	Ideal	Sl. Rg. AVA	1750	2200
150	Gen. Elec.	Sq. Cg. I K	600	2300
150	Al Ch.	Sq. C.	600	440
150	Burke	Sq. Cg. 3 BRG. 2 ph	900	220/440
150	Elect. Mach.	Syn. —	1200	4150
125	Gen. Elec.	Sq. Cg. I K	720	220/440
125	Gen. Elec.	Sq. Cg. KT547	1800	440

3 ph. 25 cy. MOTORS

H.P.	Make	Type	Speed	Volts
830	Elect. Mach.	Syn. With Direct Connected Exciter	500	2300
150	Burke	Syn. With Direct Connected Exciter	500	440
150	Gen. Elec.	Sl. Rg. I Form M	500	2200
100	Wagner	Sl. Rg. BR	750	220/440
100	Gen. Elec.	Sl. Rg. I Form M	750	220/440
100	Gen. Elec.	Sq. C. I K	750	220/440
100	Wsghse.	Sq. C. CS	500	220/440
75	Wsghse.	Sq. C. CCL	500	220/440
75	Gen. Elec.	Sl. Rg. I M	750	220/440
75	Wagner	Sq. C. BM	750	2200
75	Gen. Elec.	Var. BTA	375/750	440
50	Burke	Syn. AC133	750	220

230V D. C. MOTORS

H.P.	Make	Type	Speed
125	Gen. Elec.	CL	850
105	Gen. Elec.	CL/6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
50	West.	SK120	1700
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

MOTOR GENERATOR SET

Western Elect. 1000 Amps—40 Volts direct con. to either an AC or DC 580 RPM Motor.

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK

THE FRED W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

Now Is the Time to Throw Everything We Have at the Enemy and Save Hundreds of Thousands of American Boys

TURBOS—60 cycles

15000 KW capacity condensing, non-automatic bleeder (approved 275# 550° t.t.) volume extraction at either 100 or 65# g.b.p. Elspecs 60/3/standard voltage. Complete going unit including surface condenser, all auxiliaries and piping.

•

3—5000 KW 80% nominal, 7200 KVA range, 225# I.S.P. Elspecs 60/3/2300/3600. High percentage original full strength, otherwise necessary blading in stock.

2—3125 KVA Multi-Stage Condensing 60/3/2300/3600. One complete with surface condenser lay out and all standard auxiliaries for complete installation; One now with jet condenser, but liberal capacity surface condenser available from other stores.

3—2000 KW 80% nominal, 2500 KW approved range 60 3/1440, 2-2300, condensing design and approved for non-condensing.

•

Several 300, 500, 750, 1000, 1200 and 1500 KW condensing standard pressure, also mixed pressure design.

•

TURBOS—25 cycles

50,000 KW total aggregate capacity, unit sizes of 3,000, 6,000 to 20,000 KW surface condenser equipped complete going units. High percentage full strength.

SURFACE CONDENSERS

8250, 11000, 12000, 15000 and 20000 sq. ft. surface condenser units complete. Log service on pure clear water. Condition sound.

WATER TUBE BOILERS

2—350# ASME 80,000/120,000# t.s.g. cross drum units, underfeed stoker equipped.

WATER TUBE BOILERS (Con't)

4—1000 HP Steel Header Longitudinal Drum Type Water Tube Boilers 250# ASME Code design, and verified in recent inspection for re-erection. Now oil fired.
A complete going boiler station including modernly designed self-supported steel structure, and all standard boiler plant auxiliaries, piping, etc.
Approximately 2½ to 3 years each total log hours service.

•

3—700 HP 160,000# t.s.g. straight tube box steel header 200# ASME, without firing equipment.

•

8—400 HP 200# ASME bent tube design, superheaters, soot blowers, fans, heaters, coal and ash handling paraphernalia, etc. Also complete steel building.

•

8—650 HP Babcock Wilcox sectional header straight tube 3 longitudinal drum type 200# approved water tube boilers, superheater and type E heavy duty stoker equipped.

•

12—200/500 HP straight and bent tube 200# units.

STOKERS

5 type E heavy duty combustion engineering company stokers.

•

30 combustion engineering company multiple retort stokers.

LARGE POWER TRANSFORMERS

50,000 KVA O.I.W.C. transformers 150,000/135,000 delta—41,600/36,400; or 72,000/63,000 star.

9000 KVA transformers, as above.

15,000 KVA O.I.W.C. 60,000/54,000—18,000/9000.

12,000 KVA O.I.W.C. transformers, 16,000 through 12,000, 500 and 250 KVA unit sizes, 75,000/43,000—2300 and other standard voltage ratios.

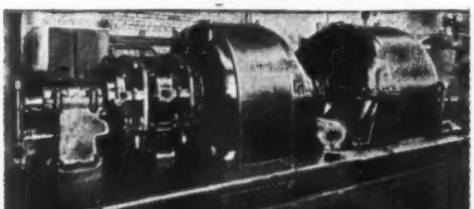
Complete data available on request.

"LOYAL COOPERATION IN HEAVY POWER MOVEMENT THRU 3 WARS"

"Now in World War II—May We Confirm Intent and Ability, Face to Face?" . . . P.S.

"HEAT and POWER"

TURBO GENERATOR SETS



1—750 KW Ridgway, 1800 RPM turbine, mixed pressure 135# Gauge 15# Absolute with C. H. Wheeler 2 Pas. surface condenser, direct coupled to a 250 Volt DC Generator 750 KW 1800 RPM.

1—GE 1000 KW Turbine 125# pressure, condensing with jet condenser, direct connected to 1000 KW generator, 3 PH. 60 Cyc. 2300 Volt 3600 RPM.

PUMPS

2—Davidson 14 x 9¼ x 16 Simplex Double acting Piston pattern, brass fitted.

1—Warren 14 x 8½ x 12 Duplex brass fitted.

1—Blake 14 x 8½ x 10 Simplex.

BOILERS

3—800 HP B & W Straight Tube Waste Heat Boilers, 200 lbs. pressure, complete with Economizers, motor driven induced draft fans, and steel stacks.

2—684 HP Edgemoor Waste Heat Boilers, 200 lbs. pressure complete with Economizers, Super Heaters, motor driven blowers and steel stacks.

2—400 HP B & W Straight Tube Water Tube Boilers, 200 lbs. pressure complete with Combustion Engineering Type E stokers and induced draft fans.

2—253 HP Heine Water Tube Boilers, 160 lbs. pressure, ASME code.

TRANSFORMERS

60 cycle, single phase

3—100 Kva Pitts. 2400/240/120 oil cooled
4—5 Kva Wsghse 2300/230/460 air cooled
3—5 Kva Gen. Elec. 460/230/115 air cooled
6—3 Kva Gen. Elec. 2300/230/115 air cooled

MOTORS

230 V. DIRECT CURRENT

Q	H.P.	Make	Type	R.P.M.
1	450	AL. CH.	INT.	425
1	150	G. E.	RC	1750
1	100	RELIANCE	1050 T	500
1	125	G. E.	DLC	550
1	100	WSGHSE	SA	250
1	75	WSGHSE	SK	1750
2	50	WSGHSE	SK160	565

3 PH. 60 CYCLE AC. 220/440 VOLT
SQUIRREL CAGE

1	125	CR. WH.	125Q	900
2	60	GEN. ELEC.	KT336	1800
1	50	GEN. ELEC.	KT327	1800
1	50	WAGNER	22VRM	600
1	40	RELIANCE		900
2	40	GEN. ELEC.	KT332	1200
2	20	Fairbanks Morse		1200

SLIP RING
2200 Volt

1	150	WSGHSE	HF	495
1	100	WSGHSE	CW	435
4	50	Fairbanks Morse	HB220B	720

SLIP RING MOTORS
440 Volt

2	150	Al. Ch.		600
1	40	GEN. ELEC.	MT332	1200
1	25	GEN. ELEC.	MT326	900
1	15	GEN. ELEC.	MT5125	900
3	10	WSGHSE	CW460C	1200

SYNCHRONOUS

2	500	WSGHSE	2200 Volt	400
1	450	WSGHSE	550	600
1	268	GEN. ELEC.	2300	600
2	200	WSGHSE	2200 Volt	900
1	125	WSGHSE	2400	900
1	105	Electric Machinery	2200 Volt	1800

Hundreds of others motors from 1 H.P. up

GEARHEAD MOTORS

220/440 volt, 3 phase, 60 cycle

Quan.	HP	Make	Type	Speed
3	40	Wsghse	CS445	258
2	25	Wsghse	CS405	258
1	15	Wsghse	CS365Y	232

GENERATORS

230 V. DC

45 KW Diehl K 18 550 RPM.
100 KW Ft. Wayne MPL 550 RPM.
100 KW GE MPL 600 RPM.
200 KW Sprague 525 RPM.
200 KW West. 500 RPM.
250 KW West. 500 RPM.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass, complete with pumps.

• TUBES

5000 CONDENSER TUBES

Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft. long, like new.

BOILER TUBES

212 New Seamless

3½" 10 ga. boiler tubes 17'1" long.

Thousands Feet of Conduit ¾" to 3"

Write for Bulletin #P-100

PUMPS

Cameron Centrifugal

Purchased New 1923

Bronze fitted, mounted on common sub-base for motor drive—

1—Size 12—700 RPM 3020 GPM 45' head 60 HP
1—Size 14—700 RPM 4700 GPM 35' head 60 HP
1—Size 14—720 RPM 5500 GPM 30' head 75 HP
1—Size 16—850 RPM 8500 GPM 45' head 125 HP

All Pumps Tested Hydrostatically For 125#
All Double Suction Volute, Gate Valves Attached

(1) Steel Plate Barometric Condenser

Pumps Handled Fresh Water From Spray Ponds.

HEAT and POWER Company, Inc.

45 BOND STREET Phone: ALgonquin 4-3874 NEW YORK, 12, N. Y.

"THEY'VE GOT EXPERIENCE 35 YEARS OF IT"

"THEY KNOW EQUIPMENT VALUES"

WHY INDUSTRY BUYS FROM BREW-WOLTMAN

"THEY'VE GOT THE CONTACTS TO GET THE GOODS"

"THEY CAN BE DEPENDED UPON"

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—18750 KVA Westinghouse Cond.
1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 6000 KVA Westinghouse Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
2— 3125 KVA General Electric Cond.
1— 3120 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1— 1563 Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 1500 KVA Allis Chalmers Non-C.
2— 1250 KVA General Electric Non-C.
1— 938 KVA West. 375# I.P. 100# B. P. N-C.
1— 625 KVA General Electric Non-C.
1— 470 Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D.C. TURBO UNITS

1—100 KW General Electric 250 V.
1— 75 KW Gen. Elec.-Terry 125 V.
3— 50 KW Gen. Elec.-Terry 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 400 KW Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Ridgway 4-valve
1— 210 KVA Skinner Uniflow
1— 187 KVA Chuse Uniflow
1— 94 KVA Chuse Uniflow

D.C. STEAM ENGINE UNITS

1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—200 KW Ridgway 4-valve 250 V. 3-wire
1—150 KW Ames Uniflow 125 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENG. UNITS—60 Cy.

1—500 KVA West. (gas) 440 V.
1—312 KVA Anderson 2400 V.
1—200 KW Worthington 2300 V.
1—200 KVA Fairbanks Morse VA 2400 V.
1—187 KVA McInt.-Seymour 2300 V.
1—125 KVA Sterling Petrol (gas) 480 V.
1—121 KVA Fairbanks Morse 240 V.

IND. REGULATORS—60 Cy.

1—72 KVA 300 A. 2400 V. Gen. Elec.
2—46 KVA 200/200 A. 2300/4600 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

WATER TUBE BOILERS

2—1452 HP B. & W. 350-lb., Stokers
1—1150 HP Badenhausen 260-lb.
1— 868 HP Connelly 250-lb., Stoker
4— 750 HP Edge Moor 200-lb.
1— 400 HP Wickes 200-lb., Stoker
1— 336 HP B. & W. 200-lb., McClave-Brooks Stoker
2— 295 HP Union Iron Wks., 180-lb., Stokers
1— 250 HP Heine Marine 250-lb.

SYNCHR. MOTORS—60 Cy.

1—1000 HP Westinghouse 2300 V. 720 RPM
1— 750 HP Westinghouse 2300 V. 720 RPM
1— 200 HP General Electric 2200 V. 1800 RPM
1— 175 HP General Electric 230 V. 225 RPM
1— 275 HP General Electric 220 V. 200 RPM
1— 100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.

4—3500 HP. G.E. slip ring 2300 V. 129 RPM
1— 600 HP. G.E. sq. cage 440 V. 900 RPM
2— 400 HP G.E. slip ring 3800 V. 1800 RPM
2— 300 HP G.E. sq. cage 440 V. 600 RPM
2— 250 HP G.E. sq. cage 2000/4000 V. 1200 RPM
1— 250 HP G.E. slip ring 2200 V. 450 RPM
3— 50-150 HP West. 2200 V. 343-679 RPM

AIR COMPRESSORS

1—1635 Ft. 100-lb. Ing. 60 Cy. motor
1—1300 Ft. 100-lb. Ing. XPV steam driven
1—1080 Ft. 85-lb. Nordberg DC motor
1— 446 Ft. 100-lb. Ing. Belted

SYN. CONDENSERS

1—2000 KVA G.E. 11000/2200 V. 720 RPM
1—2000 KVA C.W. 11000 V. 600 RPM
1— 500 KVA West. 220 V. 900 RPM

ABOVE ONLY A PARTIAL LIST

MOTORS	TURBINES
MOTOR GENERATORS	ENGINES
TRANSFORMERS	BOILERS
ROTARIES	PUMPS
COMPRESSORS	DIESELS
CONDENSERS, ETC.	MOTORS

OIL CIRCUIT BREAKERS

2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G.E. FK036 Outdoor
1— 400 A. 73 KV G.E. FHKO-36-9-BS Outdoor
1— 400 A. 73 KV G.E. FKO-36-9AS Outdoor
6— 400 A. 37 KV G.E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G.E. FKO-60-B Outdoor

MOTOR GEN. SETS—60 Cy.

1—1500 KW General Electric 660 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
2— 500 KW General Electric 600 V. DC
1— 500 KW General Electric 250 V. DC
1— 75 KW General Electric 125 V. DC

ROTARY CONVERTERS—60 Cy.

1—1500 KW Westinghouse 250 V.
1—1000 KW Westinghouse 600 V.
2—1000 KW Westinghouse 250 V.
1— 750 KW Westinghouse 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGER

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G.E. 25/60 cy. 300 RPM
1—1250 KVA G.E. 25/62½ cy. 750 RPM
1—1000 KW G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 25/60 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 200 KVA G.E. 60000-132/22800 V.
3— 200 KVA G.E. 60000-13200/22800 V.
6— 250 KVA Penn. 34500/17250-4600/2300 V.
3— 75 KVA G.E. 3300-13200/11000 V.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 6000 KVA West. 13200-2300 V. 3 ph.
3— 1500 KVA Pitts. 22000-6600 V.
2— 1000 KVA G.E. 23000/11500-575 V.
6— 833 KVA G.E. 22000-2300/4000Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G.E. 22000-11000 V.
1— 5000 KVA American 13800-2300 V.
6— 1667 KVA Pitts. 13200-2300 V.
3— 200 KVA G.E. 13200-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3— 1250 KVA G.E. 6600-550 V.
3— 667 KVA G.E. 2300/4000Y-500/480/460 V.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross
1— 2,310 sq. ft. Wheeler C. & E.

BREW, WOLTMAN & CO., INC.

50 CHURCH ST. **NEW YORK 7, N. Y.**

Famous for the Highest Standards of Integrity and Dependability

30 Years of Service

★ MOTORS ★ TRANSFORMERS

★ GENERATORS

RECOGNIZED EXPERIENCE

WE REFUSE to match wits with our customers. That is one way to run a business of this kind. It is NOT our way. But we want you to believe in us. We are confident you will do both if you understand our organization and policies.

Our Company is composed of graduate electrical engineers—Men who have had considerable experience in the design and operation of electrical machinery—Men who will gladly assist you in the proper selection of this machinery. Our shop facilities are most modern —and method of overhauling thorough.

Some of the largest corporations and most prominent engineers in the country are numbered among our regular customers.

Mr. BUYER we invite your investigations. Let us prove to you the sincerity of these assertions.

STEPHEN HALL & CO.

Slip Ring Motors, 3 Ph., 60 Cy.

H.P.	Volts	Make	Speed
500	2300	Whse.	514
400	2200	G.E.	900
400	440	Whse.	1200
350	2200	Whse.	900
350	2200–440	Whse.	600
350	220–440	G.E.	1800
350	2300–4000	G.E.	1200
300	440	Al. Chal.	900
250	2300–440	G.E.	600
200	2200–440–220	G.E.	600
200	2200–550	G.E.	1800
200	2300	Whse.	514
150	2200	G.E. MT (New)	1800
150	2200–440	Whse.	1800
150	2200	G.E.	900
125	440–220	G.E.	600
100	550	G.E.	900
100	220–440	G.E.	720
100	220–440	G.E.	900
100	550	G.E.	720
100	2200	G.E.	720
80	220–440	G.E. MTC	900
75	440/220	G.E.	600
75	440–220	G.E.	900
75	550	G.E.	900
60	2200	G.E.	720
60	220–440	G.E. MTC	900
50	2200	G.E.	1800
40	2200	G.E.	900

Squirrel Cage Motors

500	220/440	G.E.	IK	900
500	220/440	G.E.	IK	1200
400	2200/550	Whse.	CS	1800
350	440–220	G.E.		900
250	2200	G.E.	IK	600
200	440/220	G.E.	IK	720
150	2200–550	Al. Chal.		450
150	550	Cr. Wh.	SC	3600
125	550	G.E.	FT	3600
100	220/440	G.E.	IK	720
100	550	G.E.	KT	900
100	2200	G.E.	IK	600
100	220/440	G.E.	KT	900
100	2200	G.E.	IE-K	1800

SLOW SPEED SYN. MOTORS

1—60 HP—300 RPM—440/220 V 3 ph. 60 cy. GE.

1—400 HP—276 RPM—440/220 V 3 ph. 60 cy. whse. 2 brg. Type

SLIP RING MOTOR

500 HP—514 RPM—2300 V—3—60 cy Whse Slip Ring with automatic control panel

Squirrel Cage Motors (Cont'd)

H.P.	Volts	Make		Speed
75	220/440	G.E.	KT	900
75	220/440	G.E.	IK	900
75	220C/550	G.E.	KT	900
75	2200	G.E.	IK	1800
60	220– 440	G.E.	KT	900
50	550	G.E.	KT	1800
30	2200	G.E.	KT	1200

Synchronous Motors 3 Ph., 60 cy.

600	2200	Whse.	900
400	440–220	Whse.	276
350	440/220	G.E.	900
200	2300–4000	G.E.	1200
200	2200–550	G.E.	1800
150	2200	G.E. (2)	1800
100	440–220	G.E.	1200
60	220/440	G.E.	300

A.C. Generators

500 KVA, 900 rpm—2200 V. Whse. Condenser.
312 KVA, 900 rpm—2200/550 V. Whse.
300 KVA 900 rpm—440/220 V. G.E.
225 KVA, 600 rpm—2200-480-240 V. G.E.
219 KVA, 200 rpm—480 V. Whse.
187 KVA, 900 rpm—2300-550 V. Whse.
112½ KVA, 900 rpm—240-480 V. G.E.
37½ KVA, 1200 rpm—240-480 V. Whse.

Transformers—60 Cy.

3—667 KVA, G.E. 2300/4000-460 Volt.
3—500 KVA, G.E. 22,000-2300 Volt.
3—350 KVA, G.E. H-KD 13200/660-4600.
3—250 KVA, Whse. 13200-460/230 Volts.
6—200 KVA, G.E. H-KS 2300-230/460 Volts.
3—200 KVA, G.E. H-KS 6600/11000-2300 Volts.
3—200 KVA, G.E., H-KDD 13200/2300/4000Y 25 cy.
3—150 KVA, Whse. 13200-460 Volts 25 cy.
2—150 KVA, Whse. ST 13200-220 Volts 3 ph.

Transformers—60 Cy. (Cont'd)

1—600 KVA, G.E. HT 6900/11500-2200 V. 25 cy. 3 ph.
1—300 KVA, Pittsburgh 4600-220/440 V.
3—250 KVA, Kuhlman 13200-220/110 V.
3—175 KVA, Pittsburgh 6600/13200-230/460 V.
1—150 KVA, Al Chal. 440-127/220 V. 3 ph.
4—150 KVA, G.E. H-KF 2400-120/240 V.
2—150 KVA, Whse., SK, 4800/4156/3600/2400-480/240/120.
3—100 KVA, Whse., 13200-125/250.
3—100 KVA, Whse., 22,000-2300 volt.
6—100 KVA, G.E., H-KDD 6900/11950Y—230/115 v.
1—100 KVA, Pittsburgh 3 ph. 2300-460.
3—100 KVA, G.E. H-KF 4600/2300-230/460 V.
3— 75 KVA, G.E. H-KF 4600/2300-230/115 V.
1— 75 KVA, Whse., Inerteen ST 4160-416/208.
1— 75 KVA, Moloney 3 ph. 2400/4160Y-120/208Y.
2— 75 KVA, G.E., H-KS 2300-230/115.
8— 50 KVA, Whse. 2300-230/460 V.
3— 50 KVA, Whse., SK 22000/11000-2300.
3— 50 KVA, Moloney 2300-230/115.
2— 50 KVA, G.E., H-K 2200-220/110 25 cy.
3— 25 KVA, Whse., S, 2300-575.

Motor Generator Sets

1—80 KW 125 V. 1200 RPM, G.E. conn. to 120 HP 440/220 V. 3 ph. 60 cy. ind. motor.
1—75 KW 125 V. 1200 RPM Whse. conn. to CS 112 HP-220 V. 3 ph. 60 cy. Ind. Motor.
1—75 KW 250 V. 1800 RPM, conn. to 120 HP 2300/550 V. 3 ph. 60 cy. G.E. Syn. Motor.
1—50 KW 250 V. 720 RPM, G.E. conn. to 75 HP 440 V. 3 ph 60 cy. G.E. ind. motor.

D.C. Generators

KW	Volts	Make	Type	Speed
200	250	G.E.	CLC	500
125	250	G.E.	DLC	650
100	250	G.E.	CD	1450
75	250	Crocker-Wh.	H	1800
50	250	Crocker-Wh.	H	850
50	125	G.E.	C	725
25	250	G.E.	RC	1750

SYN. CONDENSER

1—500 KVA — 900 RPM whse 2200/550 V 3 ph.—60 cy. syn.

1—300 KVA—900 RPM GE 440/220 V., 3 ph., 60 cy. Syn.

Instrument Transformers—Compensators—Meters—Drum Controllers—Air Circuit Breakers—Grids Built for Your Application—Switchboards Built to Specifications

Only a partial listing, write or wire your requirements

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

"ELECTRIC EQUIPMENT" STOCK-LIST

MOTORS

25 CYCLE MOTORS

Alternators—Synchronous

3 Phase, 25 cycle

HP	KVA	Make	Type	Volts	RPM
600	KVA	G.E.	ATI	550	500
300	HP	Elec.	Mach.	440	214
100	HP	Elec.	Mach.	440	600
75	HP	Elec.	Mach.	2200	500
20	KW	Ideal		240	1500

SQUIRREL CAGE

220-440 volt 3 phase

HP	Make	Type	Volts	RPM
200	G.E.	I-K	440	1500
150	G.E.	I-K	440	750
150	West.	CS	440	1500
125	G.E.	Kt 561	440	750
100	West.	CCL	440	500
100	G.E.	I-K	440	750
75	G.E.	I-K	440	750
75	G.E.	I-K	440	500
60	Lincl.	IN	220	1500
50	G.E.	I-K	440	750
50	G.E.	KT 353	440	750
50	F-Morse	H-16B	440	750
50	West.	CS	440	750
40	West.	CS	440	750
40	G.E.	KT 343	440	750
40	Al.-Ch.	AN	440	1500
40	G.E.	KT 337	440	1500
35	G.E.	I-K	440	750
35	West.	CS	440	750
35	G.E.	I-K	440	1500
30	Wagn.	22 VBP	220	750
30	G.E.	KT	440	750
30	G.E.	KT 343	440	750
30	West.	CS Tot.En.	440	750

Also 150 motors from 20 HP. to 1 HP. all speeds.

SQUIRREL CAGE

2200 volt AC 25 cycle, 3 phase

HP	Make	Type	Volts	RPM
100	G.E.	I-K	2200	1500
100	G.E.	KT 553	2200	1500
100	West.	CCL	2200	500
75	West.	CS	2200	750
50	West.	CS	2200	750
50	Al-Ch.	AR 226M	2200	1500
50	G.E.	I-K	2200	1500
40	West.	CS	2200	750
35	I-K	G.E.	2200	500
30	G.E.	KT 337	2200	750
30	West.	CS 753	2200	750

SLIP RING

3 phase, 25 cycle

125	Al-Ch.	AN	440	750
125	G.E.	I-M	440	1500
100	G.E.	I-M	2200	375
100	G.E.	MT 357	440	1500
75	G.E.	I-M	2200	750
75	G.E.	I-M	2200	500
75	West.	CI 756A	440	500
60	West.	CW 765A	440	750
50	Al-Ch.	ANY	220	380
50	G.E.	I-M	440	750
50	West.	CW	440	750
40	West.	CW	440	750
37	G.E.	ITC 5015	220	750
30	Al-Ch.	ARY	440	1500
25	G.E.	MT 337	220	750

25 other motors smaller than 25 HP. in Stock.

6—125 HP West. type CS, 2300 v. 60 cy. 3 ph. 3600 RPM. motors, stock shipment.

60 CYCLE MOTORS

SQUIRREL CAGE

HP	Make	Type	Volts	RPM
200	G.E.	I-K	2200	600
200	West.	CS	2200	1200
150	G.E.	I-K-16	2200	600
150	Al-Ch.	AN	2200	900
150	Al-Ch.	AR	440	900
150	G.E.	I-K	2200	1200
150	West.	CS	440	1800
150	G.E.	I-K 13A	2200	1800
125	Tmph.	TR 14	440	1800
125	G.E.	I-K	4150	450
100	G.E.	I-K	2200	720
100	G.E.	KT 556	2200	900
100	G.E.	I-K	440	900
100	Al-Ch.	AR 226D	440	900
100	G.E.	KT 543	440	1200
100	G.E.	I-K	440	1800
75	G.E.	KT 552	2200	900
75	G.E.	KT 352	440	900
75	Howell	SC	440	1800
75	West.	CS	440	1800
75	Ideal	A 306 B.B.	440	3600
60	G.E.	KT 333	440	1800
50	G.E.	I-K 15A	440	300
50	G.E.	I-K	440	720
50	G.E.	KT 542	550	900
50	G.E.	KT 336	550	1200
50	G.E.	KT	440	1800
50	F-Mse.	HO121C	440	3600
50	G.E.	KT 527	2200	1800
50	F-Mse.	B.B.	2200	3600

200 Motors 30 HP. and smaller all speeds and types in stock.

SLIP RING

400	G.E.	I-P	2200	257
300	G.E.	I-M	2200	1200
200	G.E.	I-M 17A	440	514
200	G.E.	I-M 17	550	514
200	G.E.	I-M 17	2200	600
150	G.E.	I-M 16	2200	600
150	G.E.	I-M 16	550	600
150	West.	CW	2300	720
150	Cr-Wh.	Late	440	900
150	G.E.	I-M	2200	900
150	G.E.	I-M 15	440	900
150	West.	CW 771.1e	440	1800
125	G.E.	MT 547	2300	1800
112	G.E.	ITC 5015	550	514
100	G.E.	MT 356	440	900
100	G.E.	I-M	440	900
100	G.E.	I-M	440	1800
75	Al-Ch	ANY	440	514
75	G.E.	MT 556	550	720
75	G.E.	MT 356	2200	720
75	G.E.	I-M	220	1800
60	G.E.	MT 556	440	600
60	G.E.	MT 352	440	720
60	G.E.	MT 346	440	900
50	G.E.	I-M	440	514
50	G.E.	MT 352	2200	720
50	G.E.	MT 352	220	720
50	G.E.	MT 346	2200	900
50	G.E.	I-M	440	1200
50	G.E.	MT 536	440	1200
50	West.	CW	440	1800
50	G.E.	I-M	440	1800

50 Smaller slip ring motors 15 HP. and smaller any speed.

DIRECT CURRENT MOTORS

CONSTANT SPEED—115 volt

HP		Make	Type	RPM
100	KW	G.E.	DLC	1000
75	KW	G.E.	CD 145	720
75		Sprague	LC	700
60		Rel.	Intpl.	1200
20	KW.	G.E.	DLC	650
20		G.E.	RC 31	1200
20		G.E.	RC 30	1150
15		G.E.	CVC 116	700
15		G.E.	CVC 115	925
15		W.S.H.	SK	1150
15		G.E.	RC 29	1200
10		West.	SK	1120

50 Motors—115 volt—10 H. P. and under, all speeds.

VARIABLE SPEED—115 volt

30	Nthn.	20801	250/1000
25	West.	SK	1100/2200
15	G.E.	RC 12	575/1150
15	West.	SK	1110/1650
10	West.	SK 91	250/1000
7½	G.E.	RF 9	600/1800
7½	G.E.	RA 30	650/1300
5	G.E.	RF 8	650/1950
2	G.E.	CD 73	500/2000

CONSTANT SPEED—230 volt

300	G.E.	DMC INT	800
100	G.E.	CD 123	1200
75 KW.	Cr. Wh.	81 H Gen.	725
75	Cr. Wh.	516761	1050
60	G.E.	RC 34	1050
60	Al-Ch.	E 123	1800
60	West.	SK 123L	1800
50	Cr. Wh.	CMC-H50	750
50	Rinc.	310T	900
50	Al-Ch.	E 123	1200
40	G.E.	RC 15	700
40	G.E.	RC 31	700
40	West.	SK	775
40	G.E.	LC	930
40	G.E.	RC	1050
40	G.E.	DLC	1050
40 KW.	West.gen.	SK	1800
35 KW.	G.E. gen.	DLC	900
30	West.	SK 133	600

Also 130 other DC motors—40 HP. and smaller any speed.

VARIABLE SPEED—230 volt

175	G.E.	DLC 208	650/ 925
80	Burke	CD 60	200/ 625
60	Sprg.	Intpl.	480/1100
50	G.E.	RLC	400/1200
35	West.	SK	500/1500
35	G.E.	RLC	500/1500
35	West.	SK 150	400/1200
35	G.E.	RF 14	400/1200
30	West.	SA 8	500/1500
30	El. Dy.	208	400/1200
25	West.	SK 140	400/1200
25	El. Dy.	208	410/1200
20	West.	SK	400/1200
20	G.E.	RLC 115	600/1200
20	G.E.	RLC 203A	300/ 900
15	West.	80 L	1150/1800
15	G.E.	RF 13	300/ 900
15	West.	SK 93	600/1800

45 motors, 230 volt DC variable, all speed, 13 HP. or smaller.

MOTOR GEN. SETS

250 Volts DC.

1—300 KW. Al. Ch. late factory built set, 250 v., 900 rpm. comp. intpl. on base to 710 KVA. Al. Ch. synch. motor, 2300 v., 60 cy., 3 ph. 900 rpm. with panels.
150 KW Ridgeway 900 speed 2300/60/3/900.
1—100 KW. Cr. Wh. factory built set 275 v. DC. 1800 rpm. comp. intpl. on base to 150 HP. Type SC Cr. Wh. motor, 2200 v., 60 cy., 3 ph.; 1800 rpm. with starter.
1—50 KW. G. E. type RC, 250 v., 900 rpm. on base to 75 HP. KT 552 motor 2200 v., 60 cy., 3 ph., 900 rpm.

125 volt DC.

1—75 KW. G. E. type RC 18, 125 v., 720 rpm. comp. intpl. factory built to 115 HP. G. E. type I-K, sq. cg. motor, 2200 v., 25 cy., 3 ph. 750 rpm. with starter.
1—35 KW. G. E. type CD 95, 125 v., 1800 rpm. factory built comp. intpl. to 50 HP. G. E. type FT 527, sq. cg., 2200 v., 60 cycle, 3 ph., 1800 rpm. complete.
1—30 KW West. type SK factory built, 125 v., 1200 rpm. to 50 HP. West. type CS 440 v., 60 cy., 3 ph. 1200 rpm. motor, complete.
1—17 KW. G. E. type CVC set, 125 v. 1200 rpm. comp. intpl., to a 25 HP. G. E. type I-K, sq. cg. motor, 550 v., 60 cy., 3 ph., 1200 rpm.
We also have 15 Mo. Gen. Sets 15 KW. and smaller, 125 v. or 250 v. Send us your inquiries.

LOW VOLTAGE

1—850 Ampere G. E. type CD factory built, 32 v., 1200 rpm. comp. intpl. on base to 40 HP, G. E. type KT 532 motor, 440 v., 60 c., 3 ph., 1200 rpm.
1600 Amps. 60 V. G.E. 1200 speed—AC or DC Drive.

AC GENERATORS

60 CYCLE

HP	KVA	Make	Type	Volts	RPM
300	KVA.	G.E.	ATB-PB	480	720
250	HP.	West.	4846672	240	1800
240	HP.	G.E.	ATI	200	514
225	KVA.	G.E.	ATB	200	720
200	KW.	G.E.	ATB-PB.	550	720
200	HP.	G.E.	ATI syn.	2300	900
150	KW.	West.	640451	2200	600
150	KW.	G.E.	ATI	2300	900
150	KW.	G.E.	ATB-PB	600	900
120	KW.	G.E.	ATB-PB	2300	720
105	HP.	El.Ma.	BRT	2300	1800
100	HP.	G.E.	ATI PB	2300	900
100	HP.	G.E.	ATI-PB	220	900
75	KW.	G.E.	ARB-PB	2300	900
75	KW.	G.E.	ATB-PB	550	900
60	KVA.	G.E.	ATB-P	2300	900
60	HP.	G.E.	ATI-PB	4000	900
54	KVA.	G.E.	ATB	220	900
50	KW.	G.E.	TRB	240	1200
50	KVA.	West.	Ac gen.	240	1200
37½	KVA	G.E.	ATB-PB	240	1200
25	KW.	G.E.	TAB	240	1800

40 Generators AC. in stock 20 KW. or smaller. Write for details.

1250 HP IDEAL, 4000/2300 Volt, 1200 RPM, Direct Conn. Exciter
1250 HP Syn. AC Generator

SPECIALS

BOILERS:
3—150 HP. Wickes H.R.T.

STOKERS:
3—Combustion Engine Ring.

TRANSFORMERS:
70—50 KV. G.E. 2300/115/230
38—50 KVA G.E. 60 cy. 2300/115/230.

ENGINE GENERATORS:
1—625 KV. Corliss 220 V., 60 cy.
1—600 KVA Corliss, G.E. 60 cy. 220V.
1—1000 KW Wsghse, 250 V., Penn Harris, cross comp.
1—250 KW. Corliss 230-V. D.C.
1—1600 AMP. 60 V., 1200 R.P.M. D.C. Generator.

OUR STOCK INCLUDES THE FOLLOWING

TRANSFORMERS
METERS
MOTORS
SAFETY SWITCHES
PANEL BOARDS
ALTERNATORS
CAPACITORS
COMPENSATORS
GAS ENGINES

We will buy for cash and resell to defense plants.

ELECTRIC EQUIPMENT CO.
63 CURLEW ST. · PHONE: Glenwood 6783 · ROCHESTER, N. Y.

"GET IT FROM POWER"

EQUIPMENT COMPANY

SPECIAL

1—25 K.V.A. Diehl A.C. Gen. 240 V., 60 Cycle, 3 Phase, 1800 R.P.M., with Belted Exciter on Base direct connected to 38-Buick Engine, can be used by gasoline or natural gas, all complete. FOB Rochester.

We also have in stock all kinds of—

TRANSFORMERS
COMPENSATORS
OIL CIRCUIT BREAKERS

All types of—
SWITCHBOARD EQUIPMENT

Generator Sets—ALL— voltages and speeds.

Send full details of Unit desired. Will quote.

SPECIAL

VERTICAL STEAM ENGINE

1—10 KW-125 V. 450 RPM Comp. Interpole Factory Bilt on Base Direct Connected to Troy Vertical Steam Engine with Fly Wheel, with governor in Fly Wheel, Excellent Condition, Factory Designed. Immediate Shipment.

MOTORS—SQ. CAGE

3 Phase—60 Cycle—220/440 Volt

100 Motors up to 15 HP — all makes and types and speeds.

Qn.	H.P.	Make	Type	Speed
1	15	West.	CS	1800
1	15	G.E.	KT	1200
1	15	G.E.	KT	900
1	20	G.E.	KT 302	1800
1	20	G.E.	KT 312	1200
1	25	G.E.	KT 30N	1800
2	25	West.	CS	1200
1	25	G.E.	KT 332	900
2	25	Line.	Nema	600
1	30	G.E.	KT 312	1800
1	30	West.	CS	1800
2	30	West.	CS	1200
1	30	G.E.	KT 336	720
1	40	G.E.	KT 323	1800
1	40	G.E.	KT 336	900
1	50	G.E.	KT 327	1800
1	50	West.	CS	900
1	50	G.E.	KT	720
1	60	G.E.	KT 333	1800
1	75	G.E.	KT 337	1800
1	75	G.E.	KT	900
1	75	G.E.	IK	720
1	100	G.E.	IK	900
1	100	G.E.	KT	514
1	125	Cr. Wh.	SC	900
1	150	West.	CS	1800

Also larger Units available. Mail your inquiries. We also carry in stock a large number of 2300 V. motors. All types, makes and speeds. Mail us your inquiries on these machines.

MOTORS—SQ. CAGE

3 Phase—25 Cycle—220/440 Volt

50 Motors in stock up to 15 HP. Send details, we will quote.

Qn.	H.P.	Make	Type	RPM
4	20	West.	CS	750
1	25	West.	CS	1500
1	25	G.E.	KT	750
1	30	G.E.	KT	750
1	40	Al.-Chal.	AR	1500
1	40	West.	CS	750
1	75	G.E.	IK	750
1	100	G.E.	IK	750
2	150	G.E.	IK	75C

Also in stock many 2300 V. motors—also all types of 25 cycle Slip-ring motors. all types and makes.

MOTORS—SLIP RING

60 Cycle—3 Phase—220/440 Volt

25 Motors — In stock up to 10 H.P.— All Speeds and types.

Qn.	H.P.	Make	Type	Speed
1	15	G.E.	MT	1800
1	15	G.E.	MT 312	1200
1	15	G.E.	MT 312	900
1	20	G.E.	MT 322	1200
1	20	G.E.	MT 326	900
1	25	G.E.	MT 326	1200
1	40	G.E.	MT 332	1200
1	40	G.E.	MT 336	900
1	50	West.	CW	1200
1	50	Al.-Chal.	ANY	900
1	50	G.E.	MT 342	900
1	60	G.E.	MT 346	900
1	75	G.E.	MT 356	900
2	75	Al.-Chal.	ANY	900
1	75	West.	CW	900
1	75	G.E.	IM	720
1	100	G.E.	MT 356	900
1	100	G.E.	IM	720
1	150	West.	HF	600
1	150	West.	CW	600
1	200	G.E.	IM	514

Also larger Units available.

MOTORS—SLIP RING

60 Cycle—3 Phase—2300 Volts

Qn.	H.P.	Make	Type	Speed
1	75	G.E.	MT 300	900
1	100	G.E.	IM	600
1	150	G.E.	IM	600
1	200	G.E.	IM	720
1	200	G.E.	IM	600
1	300	G.E.	IM	600

All types of Slip Ring controls in stock.

D.C. VARIABLE SPEED MOTORS

230 Volts

25 Motors up to 10 H.P. Any speed range.

Qn.	H.P.	Make	Type	Speed
1	10	West.	SK	500/1500
1	10	West.	SK	250/1000
1	10	G.E.	RF 11	400/1600
1	15	G.E.	RF 10	550/1650
4	15	West.	SK	500/1500
1	20	G.E.	RF	400/1200
1	25	G.E.	RF 13	400/1200
1	25	West.	SK	300/1200
1	25	Rel.	131 T	800/1600
1	25	Rel.	155 T	500/1500
1	35	West.	SK	500/1500
1	50	G.E.	RF 14	500/1500
1	100	G.E.	MPC 6	300/600

D.C.—230 V.—MOTORS

50 Motors up to 10 H.P., all speeds and makes. Send inquiries.

Qn.	H.P.	Make	Type	Speed
1	10	G.E.	RC 29A	1800
1	10	G.E.	CD	1800
4	10	West.	SK 60L	1200
2	10	G.E.	CD	1200
2	10	G.E.	RC	900
1	10	G.E.	RC	1200
1	15	G.E.	CD	1800
1	15	G.E.	RC	1200
2	15	West.	SK	1200
1	15	West.	SK	900
1	20	West.	SK	1200
1	20	West.	SK	900
1	25	West.	SK	1800
2	25	West.	SK	1200
2	25	G.E.	RC	900
1	40	West.	SK	1200
1	60	West.	SK	1800
1	75	West.	SK	1800
1	100	G.E.	CD	1200
1	150	West.	SK	1800

D.C.—115 V.—MOTORS

Qn.	H.P.	Make	Type	Speed
1	5	West.	SK 30	1200
1	5	West.	SK 284	1200
2	5	West.	SK	1800
1	7½	G.E.	RC	1200
1	10	G.E.	RC	1200
1	10	G.E.	RC	900
1	15	West.	SK	1200
1	15	West.	SK	900

Above partial listing, many others available.

A.C.—60 CYCLE—3 PHASE GENERATORS

KVA	Make	Type	Volts	RPM
25	Diehl	9	220	1800
50	G.E.	ATB-P	240	1200
75	G.E.	ATB	2300	900
100	G.E.	ATB-PB	2300	900
150	G.E.	ATB-P	240	900
180	G.E.	ATB-PB	240	600

POWER EQUIPMENT CO.

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Post Office Box 183 **Rochester, New York** **Telephone Main 569**

PROTECT YOUR PRODUCTION WITH ERIE EQUIPMENT

FREQUENCY CHANGERS

2—1250 KVA. Gen. Elect. Synchronous—motor 3/25/2200 750 RPM. direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW. General Electric 3 ph. 60 cy. 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph. 25 cy. 440 volt, 750 RPM. Complete with panels.

1—120 KVA. Gen. Elec. Induction Frequency Changer 440 V., 3 Phase, 62½ Cycle. Driving motor 100 H.P., 3/25/440/720 RPM. Complete.

SLIPRING MOTORS
25 CYCLE, 3 PHASE, 440 VOLTS

HP	Make	Type	Frame	Speed
5	G.E.	MT	303Y	750
7½	Watson	KH		650
10	G.E.	MT	523	750
15	G.E.	MT	327	750
20	W. Elec.	I	M	750
25	G.E.	MTC	5323	750
25	West.	CW	663C	750
40	Al. Ch.	ARY		750

MOTORS
3 PHASE—60 CYCLE 220/440 VOLT

HP	Make	RPM	Type	Frame
5	Amer.	600	Tot. Enc.	Ball Brg.
7½	G.E.	1800	KT	944
10	Fair.-M.	900	KBY	
10	Burke	1800		
15	Reliance	1200		2 Phase
15	Howell	900		2 Phase
15	West.	900	CS	480 C.
20	G.E.	565	I	Form K
25	G.E.	1740	KQ312	2 Phase
25	G.E.	1800	KT	312
30	Armor	695	Ball Brg.	2 Phase
50	West.	1200	MS	
60	G.E.	1800	I	Form K
75	G.E.	1800	I	Form K
100	G.E.	1800	I	Form K
100	West.	1800	CS	

150 HP. DC. MOTOR

1—150 HP Westinghouse DC motor, 230 V. 1100 RPM. Type SK. 180L. Serial No. 2,221,504.

STEEL MILL MOTORS
25 Cy.

Amt	HP	Make	RPM	Type	Volt
1—	225	Elect. Mach.	500	Synchrns	2300
2—	750	Gen. Elect.	125	Slip Ring	2300
1—1000		Allis Chalmers	293	Slip Ring	6600
1—1150		Gen. Elect.	375	Synchrns.	2300
1—1250		Allis Chalmers	294	Slip Ring	6600
4—1600		Gen. Elect.	93	Slip Ring	2300
1—2000		Allis Chalmers	294	Slip Ring	6600
1—2500		Allis Chalmers	295	Slip Ring	6600
1—2500		Allis Chalmers	146	Slip Ring	6600
1—3000		Allis Chalmers	184	Slip Ring	6600
1—5500		Allis Chalmers	370	Slip Ring	6600

MINE SLOPE HOIST

1—Connellsville Mfg. and Mine Supply Hoist—Storage capacity for 11,000 feet 1' Rope — Speed 900 ft. per minute.

Motor—500 HP Cen. Elect. Mt. Slipring 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.

WRITE -:- WIRE -:- PHONE

Inspection can be made for 30 days in operation. This machine almost new.

MOTORS
3 PHASE—25 CYCLE 220/440 VOLT

HP	Make	RPM	Type	Frame
5	Al. Chal.	720	AR	
5	Wagner	1450	Ball. B.	Enclosed
7½	West.	750	CS	
7½	G.E.	1500	KT	181
10	G.E.	750	KT	312
10	West.	750	CS	
10	West.	1500	CS	
10	G.E.	1500	I	Form K
15	G.E.	750	KT	
15	West.	1500	CS	
20	West.	750	CS	
25	West.	750	CS	
50	G.E.	750	I	Form K
50	West.	750	CS	
75	G.E.	750	I	Form K
100	G.E.	300	I 17	Form K
150	G.E.	750	I	Form K
150	G.E.	750	I	Form K
200	West.	460	CS	2200 Volt
200	G.E.	750	I	Form K
225	Elec. Ma.	500	2200 V.	Synchron.
1150	G.E.	375	2300 V.	Synchron.
200	West.	235	CW	Slipring

TRANSFORMERS

Amt	Kva	Make	Cycle	Voltage
3	25	Gen. Elect.	25	2300/115/230/460
3	40	Gen. Elect.	25	2300/230/460
3	50	Gen. Elect.	60	2300/230/460
3	250	Gen. Elect. (new)	60	13,200/2300
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pittsburgh	25	11,500/220
4	833	Al. Chal.		13,200/440
3	1000	Pittsburgh	60	2300/4600/230/460

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. D.C., 1200 RPM. Motor 180 HP. 3/60/440 V. 1200 RPM, with panels and starting equipment.

1—100 KW Westinghouse SK Synchronous. 250/275 V. 900 RPM. Motor 150 HP. 3/60/2300/900 RPM. Complete with panels and starting equipment.

1—32 KW Westinghouse SK Generator 250 V. D. C. 1800 RPM Motor 50 HP. 3/60/220/1800 RPM with panels and compensator.

SLIPRING MOTORS
60 CYCLE, 3 PHASE, 220/440 VOLTS

H P	Make	Speed	Type	Frame
10	G.E.	1800	MT	303
15	G.E.	1800	I	Form M
20	G.E.	545	MT	332
20	West.	575	CW	648A
20	West.	575	CW	Ball Brg.
25	West.	690	CW	
30	G.E.	1800	MT	327
30	G.E.	1800	I	Form M
40	West.	690	CW	748
40	West.	690	CW	748A
40	West.	690	CW	748A
40	West.	690	CW	748A
50	West.	900	CW	
60	West.	720	CW	2200 Volt
75	West.	1800	CW	
500	West.	600	CW	

25 CYCLE ROTARY CONVERTER

150 KW Allis Chalmers, 250 volt DC. Compiete with A.C. and D.C. Panels and 3 Phase Allis Chalmers Transformer 2200 volts primary 25 cycle.

ENGINE TYPE MOTOR

625 Hp. Gen. Elect. Synchronous 3 Ph. 60 Cy., 2300 Volt, 180 Rpm.

ERIE ELECTRIC CO., INC.

124 Church St., BUFFALO, N. Y.

Write *Wire*

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DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse, 1250 KVA 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10#G, back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E. 2300 V. Cond.
3125 KVA G.E. 2300 V. Cond.
1875 KVA Al. Chal. 2300 V.; Cond.
937 KVA G.E. 2300 V.; Cond.
937 KVA Wghse. 6600 V.—250 lbs.
937 KVA Al. Chal. 2300 V.—300 lbs.
780 KVA Al. Chal. 2300 V.; Cond.
625 KVA Wghse. 2300 V.; Cond.
500 KVA Wghse. 480 V.; Non-Cond.
375 KVA G.E. 2300 V.; Cond.
375 KVA G.E. 2300 V.; Non-Cond.
312 KVA Elliot 480 V.; Cond.
312 KVA C.W.-Moore, Non-Cond. (450#)
175 KVA Al. Chal.-Sturtevant 220 V.;
112 KVA Al Chal. 240 V.—Terry

STEAM ENGINE SETS

500 KVA G.E. 240 V.—Ames Unif.
375 KVA G.E.-E.B. 4 Valve; 480 V.
300 KW G.E.-Skinner Uniflow; 250 V. DC
255 KVA G.E.-Hamilton; 240 V. AC
210 KVA G.E.-Skinner Uniflow; 480 V. AC
200 KW G.E.-Skinner Uniflow; 125 V. DC
200 KW Elliot 250 V. 3 wire—Elliot 4 V.
150 KVA G.E.-Skinner; 220 V.
125 KW G. E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 250 V. DC
100 KW G.E.-E.B. 4 Valve; 125 V. DC
100 KW Elliot 250 V. 3 wire—Elliot 4 V.

STEAM ENGINES

Twin 22 x 36 Nordberg Uniflow
21 x 22 Skinner Uniflow
18 x 20 Ames Uniflow

SPECIAL — 937 KVA GENERAL ELECTRIC 3-60-2300 V. CONDENSING TURBO GENERATOR SET; EXCITER; SURFACE CONDENSOR; SWITCHBOARD.
500 KVA Wghse. 3-60-480 V. Non-Cond. Turbine Unit, Exciter, Switchboard.
210 KVA G.E. 3-60-480 V. Alternator-19x20 Skinner Uniflow Engine; Exciter, Switchboard.

COAL PULVERIZERS

8000 lb. Fuller-Bonnet
4500 lb. (2) Erie City Unitype

DIESEL ENGINE SETS

375 KVA Wghse. 3 ph., Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
200 KVA G.E. 3 ph.—Busch-Sulzer
170 KVA F.M. 3 ph. style VA.
90 KVA F.M. 3 ph.—F.M. Style VA
60 KVA (2) G.E. 3 ph.—Tipps
40 KVA F.M. 3 ph.
50 HP F.M. "VA" belted

TRANSFORMERS

687 KVA (2) Maloney 13,800-460 V.
600 KVA (2) Pittsburgh 2300—550 V.
500 KVA (3) Al. Chal. 33,000-440 V.
250 KVA (3) Packard 22,000-2300 V.
250 KVA (2) G.E. 6600—2300 V.
200 KVA (3) G.E. 2400/4160-600 V.
150 KVA (2) Maloney 2300-230/460 V.
100 KVA (3) Al. Chal. 22,000-440 V.
30 KVA (4) Packard 6600-110/220 V.

BOILERS

749 HP (4) Edgemoor 200 lb.
728 HP E.C. ver. 200 lbs.
600 HP Heine 200 lbs.
600 HP Connelly 200 lbs.
600 HP (3) Sterling 200 lbs.
562 HP Edgemoor 200 lbs.
500 HP (4) Vogt 225 lbs.
471 HP E.C. ver. 160 lbs.
400 HP Wickes Bent Tube, 200 Lbs.
250 HP (2) E. C. 200 lbs.
344 HP (2) B & W 160 lbs.

SURFACE CONDENSOR

625 Sq. Ft. Wheeler

AIR COMPRESSORS

2200 CFM Nordberg 100#—Motor & Steam driven
1080 CFM Nordberg 85#—165 HP, 230 V. DC Motor
250 CFM Chicago Pneu. 100#—75 HP AC Motor

PUMPS (motor driven)

3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
2200 GPM 400' head
1390 GPM 233' head
850 GPM 243' head
750 GPM Hill 231' head
650 GPM DeLaval 810' head
600 GPM Al. Chal. 450' head

Let MacCABE lift your Worries!

GENERAL PURPOSE 230-VDC. MOTORS

H. P.	Make	Type	R. P. M.
1—½	C. W.	C. M.	1400-SH.
1—1	C. W.	E	1200-SH.
2—2	Allis. Chal.	E-50	1750-SH.
2—3	Westgshe	CD-925	1725-SH.
1—3	G. E.	CD-55	1150-SH.
1—3	Reliance	T-224	3500-SH.
3—5	Westgshe	SK-40	850-SH.
2—5	Westgshe	SK-30	1100-Comp.
4—5	Westgshe	SK-30	1100-SH.
2—7½	Westgshe	SK-60	850-Comp.
1—7½	Westgshe	SK-40	1150-SH.
1—10	Westgshe	SK-50-L	1300-SH.
1—15	Allis. Chal.	Shunt	800
1—15	C. W.	Size 15-J	800-Comp.
1—15	G. E.	OD-75	1750-SH.
2—25	Westgshe	SK-100-L	1100-SH.
2—25	Westgshe	SK-120	825-Comp.
1—40	Reliance	RH-992	1200-Comp.
1—75	Westgshe	SK	850-Comp.

230-VDC. CRANE & MILL MOTORS

H. P.	Make	Type	R. P. M.
1—1	P & H	5½x3½	850
2—2	Shaw	BE	930
1—2½	G. E.	C. O. 2502	750
1—2½ (New)	Reliance	T-224	1600
4—3	Shaw	BE	930
1—3½	G. E.	C. O.-2503	975
1—5½	G. E.	C. O.-2504	725
1—6	C. W.	M. L.	930
1—6	G. E.	C. O.-1805	1150
1—7½	G. E.	C. O.-1806	700
1—10	G. E.	C. O.-2503	850
2—10	G. E.	M. D.-102	700
5—11/15	Westgshe	K-5	700
1—19	C. W.	BW	650
1—20	G. E.	C. O.-2504	850
1—20	Westgshe	K-6	675
1—20/25 (New)	Westgshe	K-5	975/875
2—20/30	G. E.	M. D.-104	725/575
4—25	G. E.	C. O.-1809	550
2—65/85	G. E.	C. O.-1830	700/650
1—85	G. E.	C. O.-1811	550
1—150	Westgshe	MCB-100	365

WE HAVE IN STOCK 150-DRUM AND FACE PLATE TYPE REVERSING CONTROLLERS, MANY WITH RESISTOR BANKS: 6 TO 100-HP. ELECTRIC BRAKES. 115/230/550-VDC.

220/440-V. 3-PH. 60-CY. MOTORS CRANE AND GENERAL PURPOSE

1—3	Ideal	A. E. Crane	1600
1—3	G. E.	K. Q.-730	1730-(2-Ph.)
1—3	Wagner	11-V. R. P.	860
1—5	G. E.	K. Q.-946	1200
1—5	G. E.	M. T. C.-5201	675 (25-CY.)
1—7½	G. E.	K. T.-944	1800
1—10	F. M.	OS-FW-324	1740
1—10	F. M.	OLS-326	1200
1—10/20	G. E.	K. T.-5224	600/1200
1—11	Louis Allis.	Crane	1200
1—11	P. & H.	H. W.-10-A	820
1—15	Electro Dy.	F. R.-1601	1145
1—20	G. E.	1	1200
1—22	P. & H.	H. W.-20	840
1—25	F. M.	H	900
2—25	F. M.	H	1200
1—25	Westgshe	C. I.	690
1—25	Westgshe	C. S.	900
2—25	G. E.	K. T.-326	1160
1—30	Westgshe	C. I.	690
1—30	Westgshe	C. I.	1150
2—37	G. E.	I. T. C.-5011-A	700 (25-CY.)
2—35	Westgshe	C. I.-885	900
1—35	G. E.	1-form-K	1800
1—40	G. E.	ITC-5012	600
1—40	G. E.	K-444	1800
1—35	F. M.	H-12-B	1200
1—50	G. E.	KT-346	870
1—52	G. E.	ITC-5013	600
1—75	Westgsh.	C. W.	820

VARIABLE SPEED 230-VDC. MOTORS

1—2	G. E.	R. F.	500/2000-SH.
1—3	G. E.	RLC-111	750/1500-SH.
1—3¾	G. E.	RLC-112	600/1800-SH.
1—5	Reliance	Frame F	500/1800
1—5	Reliance	Frame F-943	450/1800
1—5	Westgshe	SK-33	150/1650-SH.
1—7½	Reliance	F-953	450/1850-SH.
1—7½	Reliance	G-903	275/1650-SH.
1—7½	Westgshe	SK-103	400/1600-SH.
1—8½	Westgshe	SK-100-L	300/1200-SH.
1—10	Reliance	G-900	400/1200-SH.
1—70	Reliance	461-T	600/1200-SH.

(E.C. & AUTO PANEL WITH 70-HP. MOTOR)

AUTO CONTROL AVAILABLE FOR MOST THESE MOTORS

SPECIAL: 200-Allis Chal. slip ring, const. duty, 700, (2300 volt with control equipment) 600-HP. G.E. Synch. motor Type TS - 600 - RPM. 2200/3/60-cy. #4315876.

T. B. MacCABE COMPANY

4306 CLARISSA STREET PHILADELPHIA 40, PA.

Patterson-Kelly water heater (new) 54" x 10' high, cap., 700 GPH, 40 to 180 degrees, steam at atmospheric pressure, thermostatic controlled.

Cochrane, water filters, (2) 12,000 GPH (each) (2) 3000 to 8000 GPH (each) 105,000# heater, 16" steam, 6" pump conn., 3500 H.P. (1) live steam separator or tank, 54" x 12'

Boilers, 2—250 H.P. Heine cross drum, 160# 2—793 H.P. B. & W, 200# 2—684 H.P. Edge Moor, 200#, 6—397 H.P. B. & W, 200#

HARRY BREARLEY

Hotel Easton, Easton, Pa.

BOILER Plants for Sale, Code

820 HP. 2 units, 250#, Stokers
500 HP. 2 units, 160#, oil burn.
500 HP. 2 units, 250#, oil burn.

also separate boilers

TURBO Generator units, Cond.

2—5000 KW. 200#, 2300 v. 3600 RPM.
1—3000 KW. 200#, 600 v. 1800 RPM.
1—2000 KW. 180#, 2300 v. 3600 RPM.
1—1500 KW. 200#, 600 v. 1800 RPM.
2—1000 KW. 150#, 2300 v. 3600 RPM.

STEPHEN A. DOUGLASS CO.

630 Fort Washington Ave., New York, N. Y.

GOOD VALUES—ALWAYS

400 KW 250 V D.C. Uniflow, Non-Condensing.
300 KVA 2300 V Fairbanks Diesel Generator.
420 HP Busch Sulzer 2300 V. Diesel Set.
180 and 270 HP Worthington Diesel Generators
200 KVA 220 V Fairbanks Diesel Generator.
1574 cu. ft. 100-150 lb. Syn. M.D. Compressor.
75, 125, 200 KVA 257 rpm A.C. Generators.
360 HP Clutch Pulley off Fairbanks Diesel.
200 KW Rebuilt Turbo Generator, 440 Volt.
870 HP 3 unit Diesel Generator Plant, 2300 V.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. (1) St. Louis, Mo.

Have you anything for sale?

SPEED YOUR DELIVERY WITH THIS POWER EQUIPMENT

Used and Unused Equipment for Immediate Service IN STOCK and Guaranteed

SLIPRING—3 Ph., 60 Cy.

HP	Make	Type	Speed	Volt
200	G.E.		600	2300 V.
125	West.	CW	870	
50	West.	CW752C	1150	
50	West.	CW	1150	
50	Cleve.	MBW	1150†	
48	Lincoln	IM	720	550 V.
40	G.E.	MT543	710	
40	G.E.	MT536	850	
40	G.E.	MT5364	850	2300 V.
40	G.E.	IM	900	
40	G.E.	MS	560†	
40	G.E.	MQ342	900	
35	CW	20Q	860†	
30	West.	CW	6/1200	
30	F.M.	B12B	1150†	
30	Wagner		1150†	
25	G.E.	MTB542	600	
25	West.	CW653C	715	25 cy.
25	G.E.	MT337	720	25 cy.
25	G.E.	IM	750	
25	Howell	SR420	900	
25	G.E.	MT532	850	2300 V.
25	G.E.	MTM	865	
25	Wagner		1200	
25	G.E.	MT513	1750	2200 V.
25	C.W.	1180	1150†	
25	Wagner	BR191	1140†	
25	G.E.	MQ522	1150†	
20	A.C.	ARVW	900	550 V.
20	G.E.	MT532	720	550 V.

† Designates 2 phase.

220 V.—DIRECT CURRENT

HP	Make	Type	Speed
50	Achal.		6/1200
35	Sprague	LC	625
30	G.E.	LC	1100
30	West.	SK700L	700
20	C.W.		1750
20	C.W.		1150
20	G.E.	CQ15	925
20	West.		900
20	West.	SK110L	700
20	Sprague	D	750
20	West.	SK113BB	700
15	Roth	SVBB	3450

HOIST—SLIPRING

HP	Make	Type	Speed
60	G.E.	MTC5543	700 25 cy.
60	G.E.	MTC5343	710 25 cy.
50	West.	CW752C	1150
50	G.E.	MTC	1200
50	Imper.	BS	850†
40	G.E.	MTC5536	600
40	P.N.	AW110	900
40	G.E.	MQC5336	900†
35	West.	CI586D	870
30	G.E.	MTC5532	600
30	Imper.	BSDL	850†
30	Line.	HXI	900†
30	G.E.	KTE522	1040
20	G.E.	MTE322	660
22	G.E.	ITE5010	860
15	West.	Col460C	1150†
7½	West.	CI	1120

D. C.—220 V.—VARIABLE SPEED

HP	Make	Type	Speed
60	Sprague		6/1200
20	Sprague		750/1500
15	Diehl		375/750
14	El. Dyn.	15S	225/1350
10/6	G.E.	RLCA2	5/1500
10	Sprague	LC	850/1500
10	G.E.	RC8	850/510
10	West.	SK	500/1500
9½	Reliance		850/1700
10	G.E.	RFA19	6/1800
10	F.M.	CP	400/1200
10	West.	LCD	1000/1500
10	Achal.		5/1000
7½	Imper.	SEE	750/1200
7½	E. Dyn.	BB	225/380
7½	Reliance	T	1720/2000
7½	G.E.	CQCAV	350/400
5/7½	G.E.	RF10	3/1200
5	Diehl	LS8	1100/1725
5	El. Dyn.		875/1700
5	Sprague		8/1500
5	G.E.	RF8	650/1950
5½	West.	SK	6/1800
5/7½	Reliance	T46T	6/1800
4	G.E.	RLC113	5/1500
6	G.E.	RLCA2	5/1500
5	El. Dyn.	2S	875/1325
5	Watson	BW	5/1500
5	G.E.	RC26A	1450/5000

WELDER

50 KVA, National Elect Welding Machine Co., 440 V, 60 cy. complete

BUFFERS

No. 15—5 HP—3450	3 ph
No. 16—7½ HP—1800	60 cy
No. 17—10 HP—1800	220 V.

WEXLER ELECTRIC MOTOR CO., INC.

210 LAFAYETTE ST. NEW YORK 12, N. Y

HY WAIT FOR ELECTRIC EQUIPMENT?

ASHINGTON SHIPS WHEN WANTED!

ENGINE GENERATOR

150 KW Erie Ball 16x18, 4 valve to G.E. 220 volt, 2 or 3 ph. 60 cy. with direct conn.-exciter.

TURBINE

156 KVA Westinhouse, 3600 rpm, 3/60/240, direct conn.-exciter, 125# ISP, 4# back press.

GENERATOR

100 KVA Fairbanks Morse, belted, 900 rpm, 3/60/220.

STEAM ENGINE

90 hp. Ames 11x12, 290 rpm, 100# ISP.

GAS ENGINE

Winton Gasoline Engine direct conn. to 5 KW, 115 volt DC Gen.

AIR COMPRESSOR

Chicago 8x8, Type LSB, 125# pressure, with unloader.

BLOWER

Garden City, mill type. Inlet 29", Outlet 36x27

OTHER ENGINES, GENERATORS, BLOWERS FANS, ETC., IN OUR WAREHOUSE READY FOR SHIPMENT.

What do you need?
What have you for sale?

EXHAUST FAN

60" ILG, 2 speed, 208/3/60, Ball Bearing, with shutter

MOTORS

50 hp GE 3/60/220, 900 rpm

30 hp West SK 220 V 850 rpm, variable

25 hp West. CS 3/60/220, 1170 rpm.

500 other motors. AC and DC

POWER EQUIPMENT

Oil Separators, Steam Separators, Water Heaters, Headers, Tanks, etc.

ASHINGTON ELECTRIC CO., INC.

14 ASTOR PLACE • NEW YORK CITY • Phone: SPring 7-0415

CHICAGO'S LARGEST AND MOST COMPLETE STOCK

MOTOR-GENERATOR SETS

KW	Make	DC Volts	AC Volts
750	Wtg.	275	syn. 3/60/440
150	Ideal	250	ind. 3/60/440
100	Wtg.	250	ind. 3/60/220
100	G.E.	250	ind. 3/60/2200
100	Wtg.	125	ind. 3/60/2200
90	Wtg.	110	AC gen. 3/60/2300
80	Al.Ch.	110	ind. 3/60/2200
75	G.E.	125	ind. 3/25/440
75	G.E.	250	ind. 3/60/440
75	G.E.	250	syn. 3/60/2200
75	G.E.	125	ind. 3/25/220
75	G.E.	125	syn. 3/60/220
25	Chandys.	125	ind. 3/60/220
22½	G.E.	125	ind. 3/60/220
20	G.E.	230	ind. 3/60/230
15	Ideal	220	ind. 3/60/220
18	Wtg.	60	ind. 3/60/550
12½	G.E.	115/230	3/60/220

ADJUSTABLE SPEED D.C. 230 V.

H.P.	Make	Type	Speed
50	G.E.	C	575/1000
35/100	G.E.	CD-165Y	425/900
40	Chandys.	F-16	860/1150
35/25	G.E.	RLC203L	400/600/1200
35	Cr. Wh.	CM	375/960
25	Jantz-L.	EI	560/860
25	Wtg.	S-9	560/780
25	G.E.	DLC-25	500/1000
15	G.E.	CE	650/350
10	G.E.	LC	1000/1500
10	Reliance	92T	600/1200
15	G.E.	Canadian	700/1400
7½	Wtg. (550)	SK-48	1150/1725
7½	Reliance	46T	875/1200
5	Burke	WAM12 (2)	650/1950
5	Ft. Wayne	BRG	550/850
5.5	Westg.	3-S	975-1500
3.3	Westg.	SK-23	1300/1800
3	G.E.	CD-55	1050/1700
4	G.E.	C	800/1400
3½	Cr. Wh.	CCM	920/1175
2/3/4	G.E.	RC-4	1700/1800
2.25	Roth	2S	1550/1780
2.2	G.E.	RC4	600/1000
		115 V.	
60	G.E.	C	500/1000
20	G.E.	LC	500/1000
30	Triumph	32F	250/1000

PUMPS

Can furnish with motor

GPM	Head	Make	Type
800	325	American	KT4MB
150	80	Gould (2)	#3030
50/100	230	Gould	#1616
150	250	Swaby	#1961
400	100	Haydon	
900	70	Union	19TBP
10/40	120/70	Yeomans (2)	HVS
25/50		Economy	15/20#
125	180	Jennings	78#
100		Blackmer gasoline pump	#100

ROTARY CONVERTERS

165 KW G.E. type HCC-6-165, comp. wd. intp. 6/60 AC 250 v. DC. 1200 RPM, 440 v. transfs.

50 KW N.W. 3/60/220 1200 RPM AC to 115 v. DC.

SLIPRING CONTROL

500 HP G.E. autom. type MTC209A, 3/60/2200, 9-sec. stage panel DL128712, Diag. 30069, open.

500 HP G.E. autom. type CR2124, sec. panel, 9-sec. 3/60/2200 V. mine hoist service.

FREQUENCY CHANGERS

1000 KW General Electric 3/60/460 volt AC generator .8 p.f. 300 RPM with 1400 HP G.E. type ATI .9 3/60/460 b. 400 RPM .9 p.f. motor, 3-pedestal bearing unit amort. wdg. both ends with 33 KW exciter. Serial No. 4,900,000.

90 KW GE adj. unit. 60 HP 3/60/220 4-speed motor, with comp. pole changing sw. rated 90 KW 60/120 cy. 68 KW 60/90 cy. 70 KW 60/100 cy. 60 KW 60/80 cy.

25 CYCLE M.G. SETS

75 KW G.E. CL-6 125 v 2-brg. with 110 HP I-K 3/25/220 ind.

75 KW GE DLC-206A intp. 3-brg. with 115 HP I-K 3/25/440 ind.

BOILERS

1—300 hp. B & W 225 lbs.
3—300 hp. B & W 160 lbs.
1—205 hp. Heine water tube 150#
2—492 hp. Sterling 160 lbs. with stoker.
1—312 hp. Sterling 100 lbs with stoker.
1—516 hp. Stirling 200 lbs. with stoker.

BOILER FEED PUMPS

1—16x10x12 Union Vacuum Pump, brass lined cylinders, force feed lubricator.
1—8½x5x10 Union boiler feed pump, brass lined cylinders, force feed lubricator.

VERTICAL A.C. MOTORS

2-60	Wtg. CS	3/60/2200	1750
7½	F.M. H	3/60/220	3600
7½	G.E. KT	3/60/220	1150
5	Wag. (3)	3/60/220	1725
7½	Wag. (2)	3/60/220	1725
5	Kimble	3/60/440	1200
5	Wtg. bb	3/60/220	850

AIR COMPRESSORS

12x10 Chgo. Pn. NSB 360 CFM 100#.
Ingersoll-Rand ERI 93 CFM 100#.
Bury, 1220 CFM 30# class DCB.

FIRE PUMP MOTORS D.C.

75 HP Northwestern 230 V. 1750 RPM.
100 HP Gen. Elec. 230 V. 1640 RPM.

TRANSFORMERS

No.	KVA	Make	Volts
1	125	Kuhl.	1/60 2300/125
1	100	G.E.	3/60 9000Y/230
1	90	Kuhl.	1/60 440/1.5-6
5	75	Wstg.	1/60 3810/244/122
2	75	Wstg.	1/60 3810/244/122
1	75	Darl.	1/60 10/250
1	30	Kuhl.	3/60 220/55-100
1	15	Ft.W.	1/60 1050-2100/2200-288
1	10	Mol.	1/60 1100-2200/220/440
1	7½	G.E.	1/60 1100-2200/244/488
1	7½	G.E.	3/60 2200-4000/230/460
1	7½	G.E.	3/60 6600Y-230
1	7½	Pitts.	1/60 2200/110/220
1	7	Kuhl.	1/60 430-460/1-1.5-2
1	6	Sorg.	3/60 140/220
1	6	Kuhl.	1/60 100-5:1
1	5	G.E.	1/60 1100/2200/220/440
1	5	G.E.	1/60 1100/2200/110/440
1	3	G.E.	1/60 460/55-110
1	3	Mol.	1/60 1150/115-230
1	3	Mol.	1/60 2200/110-220
1	1.5	A.Ch.	1/60 2200/115-230

2200 VOLT COMPENSATORS

3 Phase, 60 Cycle

HP	Make	Type
150	Gen. Elec.	NR 4747
150	Gen. Elec.	CR 1034-K17
125	Westinghouse	A
125	Gen. Elec.	CR 1034-K17
75/100	Westinghouse	E
100	Gen. Elec.	NR 2724
75	Westinghouse	E
75(3)	Gen. Elec.	NR 2723
75	Gen. Elec.	CR 1034-K17
75	Gen. Elec.	NR 2742
60/75	Gen. Elec.	NR 6693-N13
60	Gen. Elec.	CR 1034-K17
30/50	Westinghouse	E
40/50	Westinghouse	E (2 of these)
50	Gen. Elec.	CR 1034-K17
50	Allis Chal.	RD-31
40	Gen. Elec.	NR 5032-N13
30/40	Allis Chal.	RD-31
35/40	F. Morse	CCOR
25	Gen. Elec.	NR 2085
60/100	Wtg. autom.	Magnetic (4)

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO, ILL.

BOILERS

1—813 HP **Edgemoor Boiler**, 200# pressure. Riley underfeed stoker.
1—335 HP **B & W Sectional Header Boilers**, 200# pressure with superheaters, hand fired grates.
2—516 HP **Sterling** 200# pressure boilers, ASME Code, with chain rate stokers.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen** Boiler, 354# pressure.
1—357 HP **HEINE** with **Riley** Underfeed **Stoker.**
1—1000 HP **Badenhausen Riley** 200# pressure with pulverizer.
1—600 HP **Connelly** 200# pressure.
2—492 HP **Sterling Boilers**, 160# pressure stokers.
1—453 HP **Sterling Boiler** chain rate stoker, 160# pressure.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
2—250 HP **Sterling Boilers**, 160# pressure equipped with gas burners and controls.
2—253 HP **Sterling Boilers**, 160# pressure with oil burners.
2—250 HP **Wicks Vertical Boilers**, 160# pressure with pulverizers.
2—500 HP **Edge Moor Boilers** 200# pressure.
4—500 HP **Voigt Water Tube Boilers** 175# pressure with chain grate stokers and all auxiliaries.
1—440 HP **B & W Sectional Header Boiler** 150# pressure, underfeed stoker.
1—522 HP **Sterling Boiler** 200# pressure with Firite Stoker.
2—484 HP **Springfield Boilers** 200# pressure.
1—484 HP **Springfield Boiler**, 250# pressure oil burners.
2—350 HP **HEINE Boilers**, 150# pressure.
1—**Complete Power Plant** consisting of 2—309 HP **Heine Marine Boilers**, 223# pressure and 2 General Electric Turbines with all auxiliaries.
2—150 HP **HRT Boilers**, 150# pressure.
1—300 HP **Locomotive Boiler** 150# pressure with all trimmings.
3—250 HP **Erie City** vertical boilers with pulverizers.
1—400 HP **Connelly Boiler** 160# pressure with new tubes and auxiliaries.
2—84" x 20' **HRT Boilers**, 150# pressure all auxiliaries.
2—150 HP **Brownell Boilers**, 125# pressure, rebuilt and guaranteed.
56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

1—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts Surface Condenser all auxiliaries.
1—3200 KW **Allis-Chalmers** Condensing **Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Turbine** 400# pressure. Surface condenser.
1—1000 KW **Westinghouse non-condensing turbine** 350# pressure 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr Non-condensing** 3600 RPM Turbine.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—125 KW **General Electric non-condensing Turbine.**

ENGINE GENERATOR SETS

1—200 KVA **Harrisburg Uniflow Engine Generator Set.**
1—750 KVA **Rice & Sargent** 3-60-600 volt engine generator.
1—480 KW **Rice & Sargent** 3-60-550 volt engine.
1—375 KVA **Chuse Corliss eng. generator.**
1—375 KVA **Chuse vertical Uniflow engine.**
2—312 KVA **Skinner Uniflow engines.**
1—166 KVA **Ames Uniflow engine generator set.**
1—220 KVA **Chuse non-releasing Corliss engine generator.**
1—100,000 gallon Water Tower 100' high.
1—48" x 150' **steel stack.**

DIESEL ENGINES

2—200 KVA **Fairbanks-Morse** Full Diesel **Engine Generator.**
1—450 HP **Cooper-Bessemer** Tex rope driven to 300 KW AC Generator.
1—**Complete Diesel Plant** consisting of 1—250 KVA **Buckeye Full Diesel**, 1—225 KVA **Atlas Full Diesel**, 1—94 KVA **Caterpillar Diesel.**
4—500 HP **Busch-Sulzer** 6 cylinder oil engines used only 300 hours.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1000 KVA **Skinner** Uniflow engine.
400 KW **Skinner Uniflow Engine Generator** set.

MISCELLANEOUS

2—400 GPM **Centrifugal Boiler Feed Pumps.**
2500 HP **Cochrane** Open Feed **Water Heater.**
1—10' x 15' **Illinois Forced Draft Chain Grate Stoker.**
1—#8 **Fuller Bonot** Pulverizer.
2—Type AA-6 10 retort **Taylor Underfeed Stokers.**
1—3 Retort **Detroit Stoker.**

SEE Fletcher FIRST!

FLETCHER SALES CO.

325 Fincastle Building LOUISVILLE, KY.

POWER EQUIPMENT FOR PROMPT SHIPMENT

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
400	West.	2200	500	CS
125/40	Cr. Wh.	2200	700	125AQ
125	Burke	220/440	1200	
125	Cr. Wh.	2200	700	125AQ
75	Burke	220/440	1200	EM
50	G.E.	220/440	720	I K

DC SERIES & CPD. MOTORS

HP	Make	Type	Speed
2	R & M	122	1000
5	R & M	125	1000
15	West.		650
25	Shaw		600
25	G.E.	CO 2002	600
50	Shaw		600
50	G.E.	RCP	1750
50	G.E.	CD115	850
50	Al. Ch.		700
100	G.E.	MD 108	480
130	G.E.	CO 1812	550
175	G.E.	MDS 190¼	475

SLIP RING MOTORS, (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G.E.	2200	393	MT 342
300	G.E.	440	600	I-M
200	G.E.	2200	240	MT 412
150	G.E.	220/440	720	I-M
150	Al. Ch.	2200	685	
150	G.E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G.E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G.E.	2200	600	I-L
150	G.E.	2200	600	I-L

TRANSFORMERS

Qu.	KVA	Make	Voltage
3	37	West.	4400/185
3	50	G.E.	22000/2200
3	75	G.E.	2300/110/220
3	100	Uptegraff	440/820
1	150	G.E. (3 ph.)	2080/230/460

OIL ENGINE DRIVE AIR COMPRESSORS

Chicago Pneumatic simplate valve type, NS03 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.
2—14x10" Sullivan 505 cu. ft. compressors.
1—10x12 Ch. Pneu. 164 cu. ft. steam compressor.

M-G SETS 3 ph. 60 cy. (Syn.)

150 KW West. 550 v. DC—2200 AC 900 RPM
65 KW G.E. 250 v. 1200 RPM—100 HP 220/440 v. AC

ELECTRIC LOCOMOTIVES

4—6 Ton G. E. Storage Battery Loco. 44" Ga. with Batteries (Can change to 36" Ga.)
2—5 Ton West. 250 v. 36" Ga. with Gathering reels.

SCREENS

2—4' x 5' Tyler Hummer Screens with Vibrator.

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

MOORHEAD-REITMEYER CO., INC.

Pittsburgh, Pennsylvania

IF YOU DON'T KNOW MACHINERY—KNOW YOUR MACHINERY DEALER

WE SELL — PURCHASE — RENT

Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters. Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

PHILADELPHIA TRANSFORMER COMPANY

2829 Cedar St. Phila. Pa.

FOR SALE

1—Fairbanks Morse Type YV, 140 KVA, 240/3/60 Diesel Generator Set.
1—Fairbanks Morse Type YV, 90 KVA, 240/3/60 Diesel Generator Set.
1—Caterpillar D46-30, 37½ KVA, 440/3/60 Diesel Generator Set.
1—G. M. C. 60 KW, 440/3/60 Diesel Generator Set.
1—Caterpillar 60 KW, 240/3/60 Diesel Generator Set.
1—International Harvester Model PD 40, 60 HP, 1200 RPM Diesel Engine.
1—International Harvester Model UD 14, 80 HP, 1200 RPM Diesel Engine.
(Belted Generator for either of the above.)
1—Ruston & Hornsby 47 HP, 270 RPM Diesel Engine with belted generator 37½ KVA, 220/3/60.

CHARLES V. FISH

Commonwealth Bldg., Allentown, Pa.

POWER PLANT EQUIPMENT

TURBO GENERATORS

5000 KW GE Cond. 2300 volts
2500 KW GE Cond. 2300 volts
2000 KW GE Cond. 600 volts
600 KW GE Cond. 600 volts
500 KW GE Extract, 600 volts
200 KW GE Cond. 2300 volts
150 KW West Non-Cond. 600 volts

TURBINES ONLY

230 HP Terry—150 lbs.
210 HP Terry—250 lbs.
175 HP GE—110 lbs.

AIR COMPRESSORS

5600 CuFt IR 35# Motor Driven
600 CuFt IR 500# Steam Driven
275 CuFt IR 110# Steam Driven
146 CuFt IR 1200# Belted
136 CuFt Chic. 110# Belted

CENTRIFUGAL COMPRESSOR

10,000 CuFt—35# Turbine Driven
7,000 CuFt 21.7# Turbine Driven

BOILERS

1—750 HP Heine—200# Stoker
5—318 HP Manning Type—190#
2—303 HP Sterling—160#
2—255 HP H.R.T. 150# Stoker
2—235 HP H.R.T. 175# Grates
2—200 HP H.R.T. 100# Grates
2—100 HP H.R.T. 125# Grates
1—400 HP Sterling 160# Stoker

CRANES

1—15 Ton 35' Span Hand Operated
1—25 Ton 53' Span Hand Operated

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

1—100,000 Gallon Tank & 100' Tower
1—357 & 250 HP Heine WT Boilers
1—30"x30" Jeffrey Roll Crusher
1—813 & 500 HP ASME 200# WT Boilers
2—500 HP 200# W. T. Boilers
1—200 KW Gen. D/C Full Diesel
1—Diesel Dredge—All complete

Boilers, all Types & Sizes—Try Us

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FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines generators, new or used.

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Large selection—All sizes and types. Generator units, marine engines, gasoline engines, auxiliaries—also boilers, steam engines, turbo generators.

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Phone—Worth 2-0455

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120 KW ENGINE GENERATOR SET

1—120 KW G.E. Co. Type TRE Generator, 3/60/2300 volts, direct connected to 125# Harrisburg Fleming Steam Engine.

HOIST

1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums, side by side, with or without AC or DC motor.

DEEP WELL PUMPS

2—600 GPM, 116 ft. head, Kingsford, size #4 Deep Well Pumps with 40 HP G. E. Co. Type CD-93, 250 V. DC vertical motors.

CRUSHERS

2—Size 36" x 48" Link Belt Double Roll Coal Crushers, product size 1½" to 3", spring relief type.

ELECTRIC EQUIPMENT FOR INDUSTRY

LET US KNOW YOUR REQUIREMENTS

REBUILT & GUARANTEED STOCK
MOTORS, D.C. & A. C. TRANSFORMERS
MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

SYNCHRONOUS MOTORS

2—150 HP W.E. Co. Type G, 80% P.F. for 3/60/220-440 volts, 1200 RPM, with direct connected exciters.
2—250 HP W. E. Co. Type HR, 100% P.F. for 3/60/2300 volts, Engine Type, one (1) at 240 RPM, one (1) at 277 RPM.

100 KW ROTARY CONVERTER

1—100 KW G.E. Co. Type TCC for 250 V—DC and 3/60/2300 V—AC, Transformer and Switchgear, 1200 RPM.

CENTRIFUGAL PUMPS

2—2700 GPM, 170 ft. head Lecourtnay Centrifugal Pumps driven by 150 HP W.E. Co. Type C, 80% P.F. Synch. motors 3/60/220-440 volts, 1200 RPM.

PLATFORM SCALE

1—15 ton Fairbanks Industrial Platform Scale, 5' x 8'.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** *714-15 EMPIRE BLDG. PITTSBURGH, PENN.*

1—400 HP Westinghouse, type CW, 3 ph, 60cy, 440V, 450 RPM slip ring motor
1—300 HP Westinghouse, 3 ph, 60cy, 440V CW slip ring motor 495 RPM
2—250 HP General Electric, 3 ph, 60 cy, 440V 1-17A 400 RPM
1—200 HP Allis Chalmers, 3-60-440V, 514 RPM
2—150 HP Allis-Chalmers, 3 ph, 60cy, 440V, 450 RPM slip ring
1—150 HP General Electric type KT, fr. 558 3-60-2200V 880 RPM
1—150 HP General Electric, type ATI, 3 ph., 60 cy, 440V 900 RPM, 0.8 PF syn. motor
1—150 HP Electric Mach. syn. motor 125 KVA, 3-60-220V, 1200 RPM
1—150 HP General Electric, 3-60-440V
1—17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60cy, 440V frame 1000, CW, 390 RPM slip ring
1—150 HP G. E., 3 ph, 60 cy, 440V, 1170 RPM, type I-6
2—125 HP Westinghouse CS774C 3-60-440V 860 RPM Ball Bearing
4—100 HP General Electric, 3-60-440V 495 RPM, MT 562 slip ring
1—100 HP General Electric type I, form K, 3-60-220V 575 RPM

Factory built, 3 bearing, Westinghouse motor-generator set, 16½ KW, 650 amp., 25 volt, 1750 RPM, SK93, generator direct connected to 26 HP, 230 V, DC, SK83 motor with complete panel.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 690 RPM slip ring
1—100 HP, G. E., 3 ph, 60 cy, 440V, 580 RPM, type I-15
2—75 HP 300 foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3 ph, 60cy slip ring motors direct connected to 500 GPM 3 stage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Westinghouse, type CW, 3 ph, 60cy, 440V, 720 RPM slip ring, 3 or 2 bearings
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring
1—75 HP General Electric, 3 ph, 60 cy, 440V, 600 RPM, MT558 slip ring
1—75 HP Western Elec. type I, 3-60-440V, 690 RPM
1—75 HP General Electric, 3-60-440V, type I, 575 RPM
1—75 HP, G. E., 3 ph, 60 cy, 220V, 1165 RPM, type KT-347
3—25/65 HP Westinghouse, frame 762C, 3-60-440V, 600/1200 RPM, 2 speed slip ring motor
1—60 HP General Electric type KT, frame 346, 3 ph, 60 cy, 440V, 870 RPM
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage 900 RPM
1—60 HP, General Electric, 3-60-440V, 720 RPM, type I form K
1—60 HP General Electric 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric 3-60-440V, KT542, 870 RPM Sq. Cage
1—60 HP, Westinghouse, 3 ph, 60 cy, 220V, 1160 RPM, type CS-644C
1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator re-wound
1—50 HP General Electric, 3-60-440V, KT 346, 870 RPM, Sq. cage
1—50 HP General Electric 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP Howell 3-60-440V 870 RPM, type SCBB ball bearing Sq. cage
1—50 HP General Electric 3-60-440V, 720 RPM, type I-K, Sq. Cage
2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
3—50 HP General Electric 3-60-440V, 575 RPM, type I-K, fr. 13A, Sq. Cage
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP, Allis-Chalmers, 3 ph, 60 cy, 220V, 1160 RPM, type AR-220D
1—50 HP, Howell, 3 ph, 60 cy, 440V, 1165 RPM, type SC50-4, ball bearing

We have a stock of 3000 motors from 1 HP to 50 HP in AC and DC. We have a very large stock of air circuit breakers up to 12000 amp.

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK, frame 160, 230V, 680 RPM
1—60 HP Westinghouse type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse, type SK, fr. 160, 230V, 565 RPM
1—50 HP Westinghouse SK200, 245 RPM 230V
1—DC Generator 45KW Bullock 120V, 375A, 900 RPM
2—40 HP C & C 230V, 250/1000 (planer)
2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type I-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25cy-440V, 730 RPM, type CI. frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25cy-440V, 720 RPM, slip ring
1—30 HP Westinghouse 3-25cy-440V, 720 RPM, CS, Sq. Cage
2—30 HP, Fairbanks-Morse, 3 ph, 60 cy, 220V, 3600 RPM, type HO, frame 12B ball bearing
1—30 HP, Wagner, 3 ph, 60 cy, 440V, 900 RPM, type 19TCM, totally enclosed fan cooled, ball bearing

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

250 VOLT ROTARY CONVERTERS

1—1500 KW., Westinghouse compound interpole 250 v. D.C., 6 phase, 60 cycle AC Rotary converter, 600 RPM.

3 single phase, 2300 Volt transformers 1—DC and 1—AC panel for above.

2—1000 KW., Westinghouse compound interpole 250 volt DC, 6 phase, 60 cycle AC Rotary converter, 900 RPM.

2—Banks of 3 single phase, 2300 volt transformers for above and 2—DC and 2—AC panels.

The above in excellent condition.

1—3120-4030 KVA, 240-310 volts, 167 RPM, 6 phase, 25 cycle, General Electric Rotary, with transformers.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

Keystone Power Plant Equipment Co.

8403 Hegerman St., Philadelphia, 36, Pa.

SYNCHRONOUS CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A. C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/400 A.C. 1200 RPM
20 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

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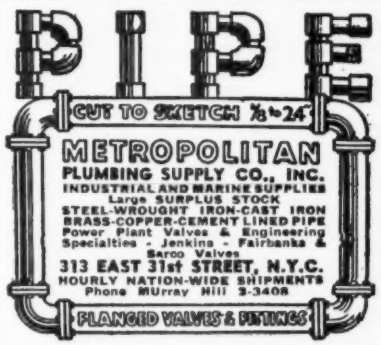

1—Westinghouse CS, 500 HP, 450 rpm, AC motor. Needs rewinding. Will rewind to any speed and voltage within capacity of frame.
1—G. E. slip ring motor, I-15A, 125 HP, 600 rpm, 440-3-60, rebuilt.
3—G. E. Transformers, 37½ KVA, 22000/115-230 volt, 1 ph, 60 cy.
1—400 amp. DC welding M-G set, 440-3-60 supply voltage.

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CANTON, OHIO

BOILERS

Turbines, Electrical Equipment, Refrigerating Equipment, Pumps and auxiliaries.

SURPLUS EQUIPMENT FOR THE WAR EFFORT.

Taken over from the E. I. Du Pont de Nemours & Company, Carrollville, Wisconsin Plant.

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DIESEL ENGINE

120 H.P. Fairbanks-Morse type 32-E full Diesel engine, twin cylinder, vertical, 360 R.P.M., with Dodge clutch pulley; also 37½ K.V.A. generator, 220 volt., 3 phase, 60 cycles and switchboards.

DENNY & CLARK
910 N. Marshfield Ave., Chicago, Ill.

1—7500 KW. 5000 v. 60 Cy. 3 Ph. TURBO with Surface Condenser
1—4000 KW. TURBO 4150 v. 60 Cy. 3 Ph.
1—3000 KW. TURBO 60 Cy. 3 Ph. 480 v.
HEAT EXCHANGER 606 tubes 1¼" x 9'6"
1500 CFM 2 STAGE AIR COMP. 275 Hp. 2200 v. 60 Cy. 3 Ph. Syn. Motor Dr.
24" Back Pressure Valve F&D
75 Ton Crane 65 span—25 Ton 50' span
200 KW. and 125 KW. ENGINE SETS (230 V. 60 Cy. 3 Ph. with Auxls.)
453 NEW STIRLING BOILER TUBES 9 GA.

1—New FAN 66750 CFM 2" to 6" Pres.
4—CENT. PUMPS 4166 GPM. 162' Head with 440 v. 60 Cy. 3 Ph. AC. Motors
1—36000 GPM, 27' head CENT. PUMPS
400, 700, 1500, and 2500 HP. A.C. Motors
TRAVELING CRANE 75 ton Case, 64' span, 3 motors. Also others.
750 KW. and 110 KW. AC HYDRO ELEC. PLANTS and others
3—559 Hp. 200# BOILERS with stokers

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

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250 KW 125 V. 320 RPM with 4 cyl. 11 x 12 vertical uniflow steam engine, equal to new unit.
NEW 400 H.P. 4 cyl. 11 x 10 Vertical Uniflow steam engine bare unit. Supply any generator.
50 KW GE 125/250 V. Marine Set.
200 K. W. 125 V. or 250 V. Skinner Uniflow engine.
750 K.W. 250 V. 720 R.P.M. interpole generator.
740 KW 250 V. induction bleeder turbo set, geared.
Boilers of all sizes, stokers, oil burners.
Turbine Sets, A.C. and D.C. to 1000 K.W.
Diesels of all sizes, large and small.

Send your lists of equipment

JAMES K. HOOPER
50 CHURCH ST. NEW YORK

Motor Generator Sets—Synchronous Motors, etc.

VERTICAL MOTORS
1—G. E. 50 HP 1200 RPM 3 ph 60 cy 220 V.
1—Reliance Fan-cooled 25 HP 1750 RPM 220/440 V.

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle
Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTORS
3 phase, 60 cycle, 220/1440 Volts
1—150 HP 1750 RPM Allis-Chalmers
2—100 HP 550 RPM Westinghouse MS
1— 75 HP 575 RPM Westinghouse CS—368-A
1— 75 HP 600 RPM Fairbanks-Morse
1— 75 HP 720 RPM Lincoln I-P
1— 65 HP 860 RPM Allis-Chalmers
1— 50 HP 690 RPM Westinghouse CS—758
1— 50 HP 875 RPM Westinghouse CS
1— 50 HP 865 RPM Ideal
4— 20 HP 870 RPM West. T.E.F.C. CS—W-405
2— 20 HP 870 RPM West. CS—W-405
2— 15 HP 860 RPM Allis-Chalmers

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

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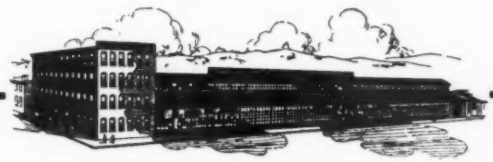

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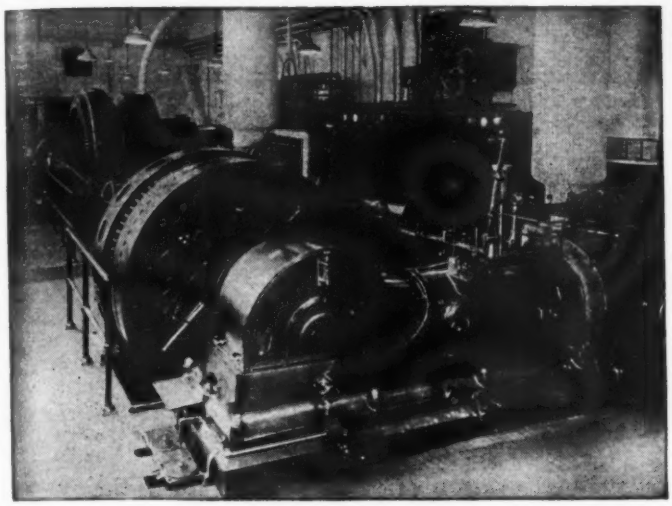

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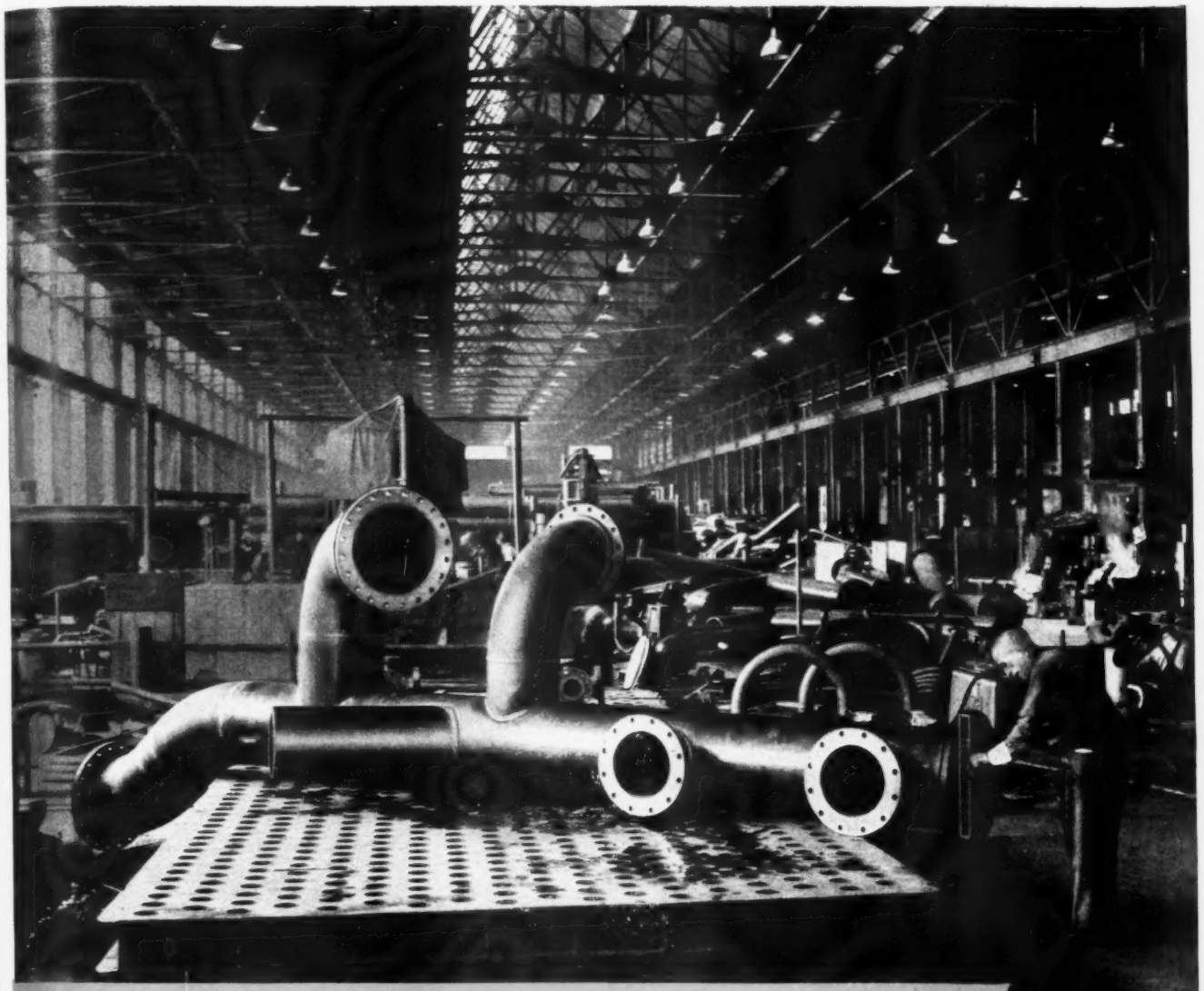

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